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DRAFT - Technical Memorandum #3
Route Alternative Summary

To: David Pergrin, Harford County Division of Water & Sewer Chris Skaggs, Northeast Maryland Waste Disposal Authority	
From: Scott Davis / Bill Lai, HDR	Project: Pumping of Reclaimed Water from Joppatowne WWTP to the NMWDA Waste to Energy Facility
CC:	
Date: November 30, 2007	Job No: 147-67242

RE: FORCE MAIN ROUTE ALTERNATIVE REVIEW AND RECOMMENDATION

1. Objective

As part of the feasibility study to evaluate re-using effluent from the Joppatowne wastewater treatment plant (WWTP) as cooling water make up for the proposed WTE, potential force main routes were screened to determine the best conceptual routes for further preliminary design analysis. The most promising routes from this analysis will be further studied to determine the best route.

This technical memo presents results of HDR's route evaluation. A matrix was compiled to assign a ranking to each route alternative. Each of the routes were screened and evaluated based on project planning issues, listed as follows: constructability, land acquisition, community impact, environmental and operations. Cost is driven by the project planning issues and was analyzed separately. As noted in Tech Memo No. 1, the approximately 3.5 mile force main will be designed as a High Density Polyethylene (HDPE) line, 10-inch diameter SDR. The main will be buried 4 to 5 feet below grade. Besides a backhoe to dig the trench, a fusion machine will also be needed to fuse the HDPE pipe and fittings as required.

2. Descriptions of Route Alternatives

As described in Tech Memo No. 2, sent November 8, 2007, the area between the WWTP and WTE was divided into four regions, each of which contains multiple route alternatives, to simplify route selection. The regions and potential routes are shown in Figure 1. Brief descriptions of each region are below. Detailed descriptions of each route follow.

1. Region 1 includes routes from the WWTP to the Foster Branch stream crossing. Due to the size of Region 1 and range of alternatives, it was spilt into two sub-regions.

a. Region 1A is for routes north of Joppa Farm Road; and
b. Region 1B is for routes on Joppa Farm Road and areas to the south.

2. Region 2 consists solely of the Foster Branch stream crossing in Robert Copenhaver Park.
3. Region 3 includes the routes from Foster Branch to Fort Hoyle Road.
4. Region 4 includes routes from Fort Hoyle Road to the WTE facility in the Aberdeen Proving Ground area off of Magnolia Road, south of the railroad tracks.

2.1. Region 1

The force main leaving the WWTP has two routes to reach the outside of the WWTP property. One route is through the main entrance to Shore Drive. The second option is through the delivery truck access road, on the eastern side of the plant, to Joppa Farm Road. Based on preliminary review of property ownership, the truck access driveway is County owned property and construction would be within the right-of-way. The truck driveway is between the post office and Joppatowne Plaza, both of which have entrances off the driveway. The main entrance is also County owned, but is bordered by wetlands on the western side.

Issues affecting the force main leaving the plant include wetlands and buried pipes. The yard piping plan, prepared by Stearns and Wheler and dated March 20, 1997, shows numerous pipes in the open area between the proposed pump station and the truck driveway which could impact this route. Wetlands are present outside the fence line along the western portion of the site and along the western side of the main entrance road. However, there are no buried pipes along the western side of the plant, so the force main can easily be routed to the main entrance inside the fence line. For this analysis, the routes exit the plant by whichever access road is closest. There will be minimal impact on the route ranking if a different exit path from the WWTP is required due to construction issues.

Region 1 was broken into two sub-regions. The sub-regions are shown in Figure 2. The force main will be routed north or south on Garnett Road as required to meet the optimum Region 2 route. The connector will be included in the Region 1 route rating.

2.1.1. Region 1A

Region 1A consists of the region north of Joppa Farm Road and extends east to Foster Branch. Three routes have been identified in this region, as described below.

1. Route 1A-1: Travel east on Joppa Farm Road, north on Barksdale Road to Baldwin Drive, east on Baldwin Drive to Jonathan Drive to Falconer Road, north on Falconer Road to end of cul-de-sac, east through the sewer easement to Trimble Road, east on

Trimble Road to Garnett Road. A possible alternative is to route the force main from Barksdale road through the County-owned water tower property to Winesap Court, then to Falconer Road. This alternative will only be evaluated if Route 1A-1 appears to be most beneficial.

2. Route 1A-2: East on Trimble Road to Garnett Road.
3. Route 1A-3: East on Joppa Farm Road, North on Barksdale Road, east through the Baltimore Gas and Electric (BG&E) utility easement to Garnett Road.

2.1.2. Region 1B

Region 1B consists of the region south of Joppa Farm Road and extends east to Foster Branch. Most of the area is within the Chesapeake Bay Critical Area. Two routes have been identified in this region, as described below.

1. Route 1B-1: East on Joppa Farm Road to Garnett Road.
2. Route 1B-2: East on Joppa Farm Road, south on Shore Drive, east on Town Center Drive, east on Joppa Farm Road to Garnett Road.

2.2. Region 2

Region 2 consists of crossing Foster Branch in Robert Coperhaver Park. The park land is County owned. There are three possible locations for crossing the stream. All other locations would require going through private property. The three locations are:

1. Route 2-1: Crossing on Trimble Road under two branches of Foster Branch. This is the northern most crossing. Each branch is in a culvert. The force main would have to go under the culverts as there is little cover above the culverts.
2. Route 2-2: Crossing through the park at the utility easement. Foster Branch has combined into one channel at this point. The crossing is in a gully.
3. Route 2-3: Crossing on Joppa Farm Road, the southern most crossing. The stream goes through one large structure with two culverts. The top of the culvert may have enough cover to allow the force main to be above the stream.

The force main will be routed north or south on Foster Knoll Road as required to meet the optimum route for Region 3. Impacts of the connector route will be included in Region 2.

2.3. Region 3

Region 3 includes routes from the east side of Foster Branch to Fort Hoyle Road. Figure 3 shows the proposed routes. The five proposed routes include routes utilizing the proposed easement through Hackley's Reserve and routes bypassing Hackley's Reserve.

1. Route 3-1: East on Trimble Road to Fort Hoyle Road.
2. Route 3-2a: East on Joppa Farm Road to Haverhill Road, then east through the future Hackley's Reserve subdivision to Fort Hoyle Road.
3. Route 3-2b: East on Joppa Farm Road, North on Haverhill Road, East on Trimble Road to Fort Hoyle Road.
4. Route 3-3a: East through the BG&E utility easement, east on Joppa Farm Road to intersection with Haverhill Road, east through the future Hackley's Reserve subdivision to Fort Hoyle Road.
5. Route 3-3b: East through the BG&E utility easement, north on Haverhill Road, east on Trimble Road to Fort Hoyle.

No routes running south on Haverhill Road were investigated as this would require going through the active quarry or would significantly increase route length along the rail line easement to reach the WTE.

2.4. Region 4

Region 4 includes routes from Fort Hoyle Road to the WTE, located east of Magnolia Road and includes the rail line crossing. These routes are shown in Figure 3 and are described below.

1. Route 4-1: South on Fort Hoyle Road, cross tracks through access gate, east along the utility easement or train track easement.
2. Route 4-2a: East through the south end of the school property, south on Magnolia Road.
3. Route 4-2b: East through the south end of the school property, cross Magnolia Road and east along new sewer easement, south to railroad tracks.
4. Route 4-3a: East on Trimble Road, south on Magnolia Road.
5. Route 4-3b: East on Trimble Road, south on Magnolia Road to new sewer crossing, east along new sewer easement, and south to railroad tracks.

The rail crossing for Routes 4-2a and 4-3a will be either hung below the overpass or under the tracks east of Magnolia Road. Unless it is determined that the pipe can be suspended below the overpass, HDR will assume this option is not feasible and the pipe must go under the tracks. The rail tracks are owned by National Railroad Passenger Corp. Crossing of the tracks is typically approved if the design is per Amtrak requirements. The casing pipe must extend 25 ft from the centerline of the outermost track at the crossing.

3. Data Collection

Harford County has a comprehensive GIS database that contained much of the information that was needed for this task. The County's GIS coordinator provided guidance and assistance in accessing this data, and the depth of the information and accessibility of this data allowed HDR to

perform some of the screening analysis on a desktop basis. The information gathered from Harford County GIS and other sources is described below.

1. Property ownership was retrieved through Harford County GIS data. Key property parcels along the route are included in Figures 2A and 2B, which show whether property is privately-owned, open space, or government-owned.
2. Easement information was from deeds and plats. Deeds were obtained from MDLandRec.net, an online system for land records maintained by the Maryland State Archives. Plats were obtained from plats.net, an online system maintained by the Harford County Circuit Court.
3. Wetlands information was obtained from Harford County GIS maps. The GIS information is from the US Fish and Wildlife Service's National Wetlands Inventory (NWI) program. Wetlands were mapped by the Maryland Department of Natural Resources (MD DNR). In addition to the DNR wetland information, areas with shallow water table soils, such as Elkton (En), Fallsington (Fs), and Othello (Ot) loams, are shown. These shallow water soils represent potential wetland areas. The wetlands map is shown in Figure 3.
4. Rare, threatened, and endangered species information was obtained from Harford County GIS maps. The GIS information includes Natural Heritage Areas, Wetlands of Special State Concern, Colonial Waterbird Colonies, and Habitat Protection Areas. Figure 4 shows the sensitive species areas.
5. Forest Interior Dwelling Species (FIDS) habitats were obtained from Harford County GIS maps. The locations are based on a model predicting where FIDS habitats may occur and have not been field verified. FIDS habitats do not indicate the presence of sensitive species. Potential FIDS habitats are shown in Figure 4.
6. Flood plain information was obtained from Harford County GIS maps. 100-yr and 500-yr flood plain information is plotted. For route analysis, only the 100-yr flood plain is included. The flood plain information is in Figure 5, which also shows the Chesapeake Bay Critical Area.

HDR also visited the site to visually detail the potential routes and review the environmental and construction issues along the potential routes.

4. Cost Analysis

Preliminary cost analysis was performed to aid in route selection. The rough cost analysis compared cost per linear foot for installation of 10" pipe in either undisturbed areas or under pavement. Additional unit costs were added for length of jack and bore under the tracks and number of minor stream crossings. Land acquisition was not included in the cost, but is noted

where required. Utility crossings are not included in the cost analysis. Unit costs are presented in Table 1.

Table 1: Unit Costs for Route Analysis

		Unit	*Unit Cost*
Open trench force main installation w/ restoration	In unpaved areas	$/ft	$80-$100
	In paved areas	$/ft	$110-$125
Minor Stream Crossing		$/ft	$500
Jack and bore force main installation		$/ft	$500

The force main installation cost includes traffic control and pavement restoration for paved areas. A range of costs were used to reflect more difficult construction areas. For instance, work in wetlands will require additional erosion control and restoration, so the cost per linear foot is higher.

5. Route Analysis

Proposed routes were compared using the criteria in Table 2 below. There are five categories, with potential impact factors identified for each category.

Table 2: Route Alternative Ranking Criteria

Evaluation Factor	Description	Unit of Measure	Weighting Factor
Operations Impacts			
Maintenance Accessibility	Maximum distance from an access road	Linear Foot	1
Community/Traffic Impacts			
Local Businesses	The length of an alignment within a commercial/business zone.	Linear Foot	1
Schools	Distance to the nearest school being affected.	Linear Foot	1
Residential	Length of alignment within a residential zone	Linear Foot	2
Intersections Affected	Number of intersections affected.	Each	1
Truck Routes	Length of existing truck routes in alignment.	Linear Foot	2
Environmental			
Chesapeake Bay Critical Area	Length of alignment within Chesapeake Bay Critical Area	Linear Foot	4
Wetlands and Vernal Pools	Length of alignment within Wetlands or Vernal Pools	Linear Foot	3
Length in 100-yr Flood Plain	Length of alignment in 100-yr Flood Plain	Linear Foot	2
Minor Stream/Water Crossings	Number of minor stream/drainage swale crossings. (Not including major water crossing of Foster Branch.)	Each	2
Sensitive Species	Length of alignment through sensitive species habitats	Linear Foot	4
FIDS Areas	Length of alignment through possible FIDS areas	Linear Foot	1
Construction Complexity			
Tree Clearing	Acres of tree clearing necessary for alignment.	Acre	3
Utility Conflicts	Number of occurrences of alignment impinging on utility or utility buffer zone.	Each	5
Construction Duration	Estimated time to complete project.	Months	4
Foster Branch Water Crossing	Distance of water crossing and buffer.	Linear Foot	5
Railroad Crossings	Distance of railroad and buffer.	Linear Foot	5
Length on County/Local Roads	Length of State/County/Local roads encountered during alignment.	Linear Foot	3
Emergency/Evacuation Routes	Length of existing emergency/evacuation routes.	Linear Foot	3
Land Availability			
Easement Acquisition	Length of easement to be acquired throughout alignment.	Linear Foot	2

Cost is calculated separately and is not included in the evaluation matrix. Variables such as construction complexity and land acquisition will impact cost, which would lead to cost being measured twice in the matrix.

The ranking of the various potential force main alignments was achieved by applying a ranking system to the potential impact factors within each of the five evaluation categories. Prior to

reviewing the alignment alternatives, each impact factor was assigned a "weight." This "weight" represents the level of importance the specific factor is deemed to be with respect to the selection of a force main alignment. Weights range from 1 to 5, with 5 representing the highest level of importance. The level of importance was determined through a combination of value engineering and the client's specified preferences. Once a weight was assigned to each impact factor, the various alignments were scored from 1 to 10 for each impact factor, with 10 being the lowest impact (or most favorable) and 1 representing the highest impact (or least favorable or most negative). Scores were determined by the unit of measure identified in the table above. After a score was assigned for a particular impact factor, the weight system was applied to determine the significance of each of the factors used to evaluate the alignments. The most reasonable and feasible force main alignments were then identified by the "highest ranking".

Parameters with the highest weighting factors include length in the Chesapeake Bay Critical Area, utility conflicts, length of the Foster Branch crossing, and length of the rail line crossing. The utility conflicts include access to the BG&E easement and crossing existing underground utilities.

5.1. Operations Impact

The main issue with operations is ease of repairing pipeline or accessing the air relief valves and flushing hydrants. The impact is measured as the furthest distance from the pipeline to an access road.

5.2. Community/Traffic Impact

Community impact includes the length of the route through commercial and residential areas. The distance to the nearest school is included, however the weighting factor is low since construction could be performed during summer break.

Traffic impacts include the length along truck routes and the number of intersections affected. Magnolia Road and Fort Hoyle Road were considered truck routes for this analysis. Magnolia Road is considered a truck route due to garbage trucks traveling to the WTE and is the main traffic entrance to the WTE. Fort Hoyle Road is considered a truck route due to trucks traveling to the quarry, although this road is looped and the truck traffic is less than the trucks entering into the WTE.

5.3. Environmental Impact

Impact on the environment is the most important evaluation factor in the analysis, due the potential for additional permitting and restoration requirements. Key environmental parameters are length of the route through the Chesapeake Bay Critical Area, through wetlands, and through

sensitive species habitats. As described above, areas with shallow water table soils, which represent potential wetland areas, were included in this analysis.

Additional environmental impacts are length of the alignment through FIDS habitats, number of minor stream crossings, and length of the alignment in the 100-yr flood plain.

5.4. Construction Complexity

Construction complexity will greatly affect the cost and feasibility for each route, and is therefore an important part of the evaluation. Main parameters are number of utility conflicts, construction duration, length of the railroad crossing, and the length of the Foster Branch crossing. An additional factor related to the railroad crossing is the distance away from the WTE, which would impact the amount of force main construction on Federal property south of the tracks. This impact is shown in easement acquisition.

Utility crossings were counted for each route and include stormwater, water mains, and sewer lines. Buried electrical lines, gas mains, and communication line locations were not available during the analysis and were not counted in the utility crossings.

Construction duration is estimated using average length of pipe that can be installed per day via open trench construction in paved and unpaved areas. The construction duration also includes a value for length of pipe installation per day via jack and bore. The duration estimate is based on average values for pipe installation and does not represent an accurate project schedule; however the ratio for construction duration between different options is accurate.

Other issues used to determine construction duration include acres of tree clearing, which could also be an environmental impact, and the length of the alignment along roads, which requires pavement restoration and traffic control and likely will have more buried utilities present. The length of the alignment through designated emergency routes was originally included in the matrix, however research did not show any designated emergency routes in the project area.

5.5. Land Availability

Land availability includes both land purchase and easement acquisition for routing the force main and was measured in length of alignment requiring an easement. Land availability has a low weighting factor since our initial review suggests construction in the easement will be feasible.

Review of plats and deeds show the utility easement to be in either County-owned property or privately-owned designated open space areas. The County-owned property was originally owned by Joppatowne Utilities Corp, was deeded to the Maryland Environmental Services, and was then deeded to Harford County. The easement is shown on most plats as a US Government ROW and

no records have been found showing a ROW for BG&E, although we realize that discussions with local officials have indicated otherwise.

5.6. Cost

The costs provided below are in 2007 dollars for the Baltimore, MD area and reflect installation of the pipe and restoration only. The costs are provided to enable direct comparison between the routes and do not reflect actual construction cost estimates. No contingency, insurance, permitting, or design costs are included.

6. Results of Route Review

6.1. Region 1 Route Analysis

The optimum route out of the treatment plant is anticipated to be exiting via the main entrance road. There are fewer buried pipes encountered to reach the main entrance road. However, the entrance road is narrow and would require complete reconstruction after installation. The truck entrance is wider and would allow easier construction, but truck traffic can not be disrupted during construction. Final routing of pipe to exit the WWTP will be determined during pump station design.

Analysis of the five routes in regions 1A and 1B are summarized in Table 3 below.

Table 3: Region 1 Analysis

Route	*Operations*	*Community*	*Environmental*	*Constructability*	*Land Availability*	*Total Score*	*Relative Cost*
1A-1	10.0	45.0	99.0	41.0	20.0	215.0	$1,467,000
1A-2	10.0	46.0	111.0	50.0	14.0	231.0	$1,424,500
1A-3	7.0	59.0	97.0	96.0	2.0	261.0	$852,000
1B-1	10.0	49.0	105.0	58.0	20.0	242.0	$1,029,000
1B-2	10.0	49.0	94.0	58.0	20.0	231.0	$1,097,500

The optimum routes through Region 1 are routes 1A-3, through the utility easement, and 1B-1, via Joppa Farm Road, which have the highest scores and lowest costs. The environmental impact is higher with Route 1A-3, but community impact is the lowest, construction is easiest, and cost is lowest.

Route 1B-1 is a viable alternative if easement issues are encountered in route 1A-3. The Joppa Farm Road route has low environmental impact. Construction will be more difficult since the route is through paved roads with numerous utility crossings.

6.2. Region 2 Route Analysis

Analysis of the three routes in region 2 is summarized in Table 4 below.

Table 4: Region 2 Analysis

Route	*Operations*	*Community*	*Environmental*	*Constructability*	*Land Availability*	*Total Score*	*Relative Cost*
2-1	10.0	80.0	107.0	175.0	20.0	392.0	$107,500
2-2	10.0	80.0	122.0	163.0	14.0	399.0	$240,700
2-3	10.0	80.0	107.0	163.0	20.0	390.0	$216,250

The crossing of Foster Branch appears to have similar impacts for all three options, although there is a significant cost difference. Route 2-1, which crosses at Trimble Road, has a cost 50% lower than the next lowest option. In addition, the County recently installed a force main under the culverts at this location by direct buried construction. The cost above assumes jack and bore construction. This crossing is the shortest, and traffic impact will be less on Trimble Road than crossing at Joppa Farm Road. The main reason that Route 2-2 has a lower environmental impact is the lack of designated wetlands or shallow water table soils at this crossing. Route 2-3 will be ideal crossing from Route 1B-1 as the increased cost to travel north on Garnett Road will be approximately $200,000.

6.3. Region 3 Route Analysis

Analysis of the five routes in region 3 is summarized in Table 5 below. All routes were included in the analysis, since a definitive easement trough Hackley's Reserve has not been identified. It is expected that an easement could be granted if required.

Table 5: Region 3 Analysis

Route	*Operations*	*Community*	*Environmental*	*Constructability*	*Land Availability*	*Total Score*	*Relative Cost*
3-1	10.0	66.0	160.0	126.0	20.0	382.0	$264,000
3-2A	7.0	66.0	127.0	120.0	20.0	340.0	$399,500
3-2B	10.0	37.0	133.0	82.0	20.0	282.0	$676,500
3-3A	7.0	69.0	127.0	120.0	6.0	329.0	$301,000
3-3B	10.0	60.0	133.0	82.0	6.0	291.0	$571,000

Route 3-1 appears to be the recommended alternative in this region. The cost is lowest and the impact is significantly lower than the other options. Environmental impact is lowest since the route is entirely in existing roadways. Construction difficulty has the lowest score, even though the route is in existing roadway. Route 3-1 has the shortest distance to reach Region 4, which decreases the construction duration and gives the lowest construction difficulty rating.

The impact of route 3-2A is high largely due to the environmental impact of crossing through Hackley's Reserve. Since a sub-division in this parcel already has final approval, the area will be impacted by the sub-division construction. If the environmental impacts are considered less important in this region, route 3-2A is worth considering.

6.4. Region 4 Route Analysis

Analysis of the three routes in region 4 is summarized in Table 6 below. Route 4-1 crosses the tracks west of Magnolia Road and parallels the tracks to the WTE. Route 4-1 can go just off the tracks or along a utility corridor that parallels the tracks, however each route will require an easement. Routes 4-2A and 4-3A follow Magnolia Road and cross the tracks east of the overpass to avoid wetlands and minimize the route length in private property. Routes 4-2B and 4-3B follow the new sewer line installed east of Magnolia Road.

Table 6: Region 4 Analysis

Route	*Operations*	*Community*	*Environmental*	*Constructability*	*Land Availability*	*Total Score*	*Relative Cost*
4-1	3.0	36.0	140.0	114.0	6.0	299.0	$796,500
4-2A	5.0	47.0	112.0	130.0	14.0	308.0	$510,500
4-2B	3.0	64.0	104.0	132.0	14.0	317.0	$509,000
4-3A	7.0	25.0	124.0	94.0	14.0	264.0	$836,500
4-3B	3.0	25.0	116.0	79.0	14.0	237.0	$872,000

Based on this analysis, the route with the least impact is Route 4-2B, which has the second lowest cost and easiest construction. Environmental impact is high due to wetlands and potential FIDS habitats located east of Magnolia Road. There are also shallow water table soils, which suggest wetlands could be present, in the southern portion of the Magnolia Middle School property, although there are no registered wetlands on the school property. The rail crossing is expected to be easiest at this location as the area is flat and there is ample room for staging. Route 4-1 has minimal environmental impact and should be considered also, although the relative cost is higher.

6.5. Final Route Analysis

Based on the results matrix, the ideal alignments are as described below. Option 1 uses routes 1A-3, 2-1, 3-1, and 4-2B. Option 2 uses routes 1B-1, 2-3, 3-2A, and 4-1.

For Option 1, the force main follows the route described below:

- Leaves the WWTP;
- Goes east on Joppa Farm Road;
- Turns northeast on Barksdale;
- Goes east through the BG&E easement to Garnett Road;

- Goes north on Garnett road to Trimble Road to connect route 1A-3 with route 2-1;
- Crosses Foster Branch on Trimble Road;
- Travels east on Trimble Road;
- South on Fort Hoyle Road to connect route 3-1 with route 4-2B;
- East through the southern portion of the Magnolia Middle School property to Magnolia Road;
- Crosses Magnolia Road and follows the new sewer line east through the woods;
- Turns south to the rail crossing and WTE.

Option 1 requires adding in approximately 900 ft along Garnett Road to connect route 1A-3 with route 2-1 and approximately 2,250 ft along Fort Hoyle Road to connect route 3-1 with 4-2A. These impacts are added in the table below and shown in the cost. The Garnett Road connector and the Fort Hoyle Road connector add cost to this option that is not shown in the tables above.

For Option 2, the force main will follow the route described below:

- Leaves the WWTP;
- Goes east on Joppa Farm Road to the end at Haverhill Road, crossing Foster Branch along the way;
- Goes east through Hackley's Reserve to Fort Hoyle Road;
- South on Fort Hoyle Road;
- Crosses the railroad at the access gate on Fort Hoyle Road;
- Runs east parallel to the rail tracks to the WTE.

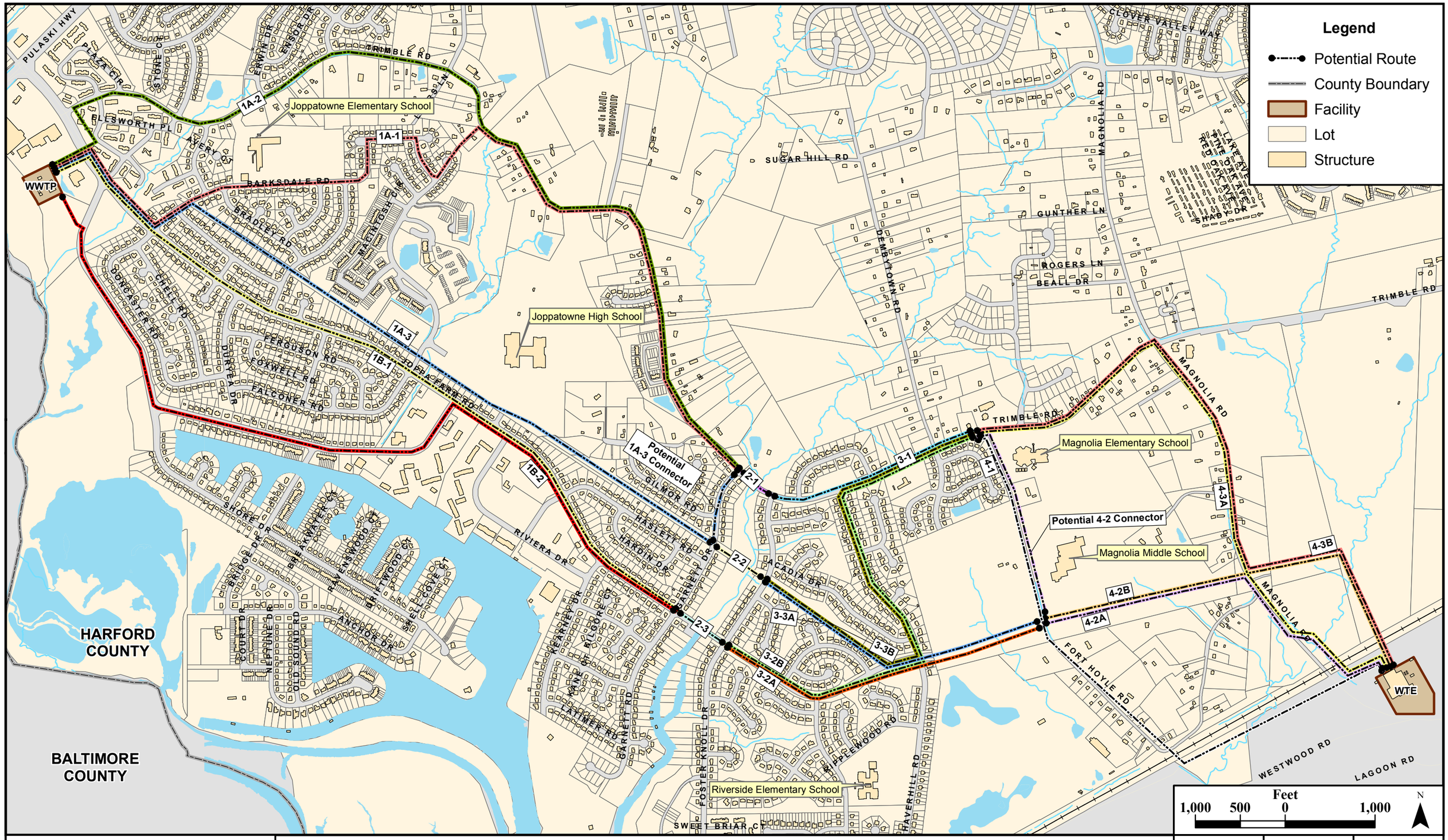
Table 7: Final Route Analysis

Route	*Operations*	*Community*	*Environmental*	*Constructability*	*Land Availability*	*Total Score*	*Relative Cost*
Option 1	30	261	468	501	56	1316.0	$2,085,000
Option 2	30	231	479	455	66	1261.0	$2,441,250

Option 1 is routed largely through existing easements, and has the highest score and lowest cost, although the differences are small. Option 2, routed largely through local road ROWs, is a viable option, particularly if the BG&E easement is not accessible, or if the construction requirements in the easement are too restrictive. Option 1 is easier construction, but the need to acquire an easement lowers the final score. Construction for option 2 is more labor intensive since most of the route length is through roadways, although pipeline routing is acceptable through these areas. Option 2 would require acquisition of an easement through Hackley's Reserve. As seen by comparing routes 3-2A and 3-2B in Table 5 above, there will be a significant increase in cost if the no easement can be acquired. In addition, if route 3-2B were required, a connection along Fort Hoyle Road would be required. The two recommended routes for final analysis are shown in Figure 6.

The relative cost for construction of the force main is similar for both final options, although option 2 is higher. The cost does not include land acquisition, if required, insurance, contingency, design fees, or permitting fees and is presented solely for relative cost comparison between options.

If the findings from this screening evaluation are found acceptable, the next step would be performing a more in depth analysis of the final options, including developing a profile of the alternate routes, evaluating property and easement requirements, railroad requirements, and permitting requirements. The routes can be modified if desired.



HDR | LMS	NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY POTENTIAL FORCE MAIN ROUTES: JOPPATOWNE, HARFORD COUNTY, MARYLAND	Job No. 0067642 | Date 11/30/07 | Figure No. 1

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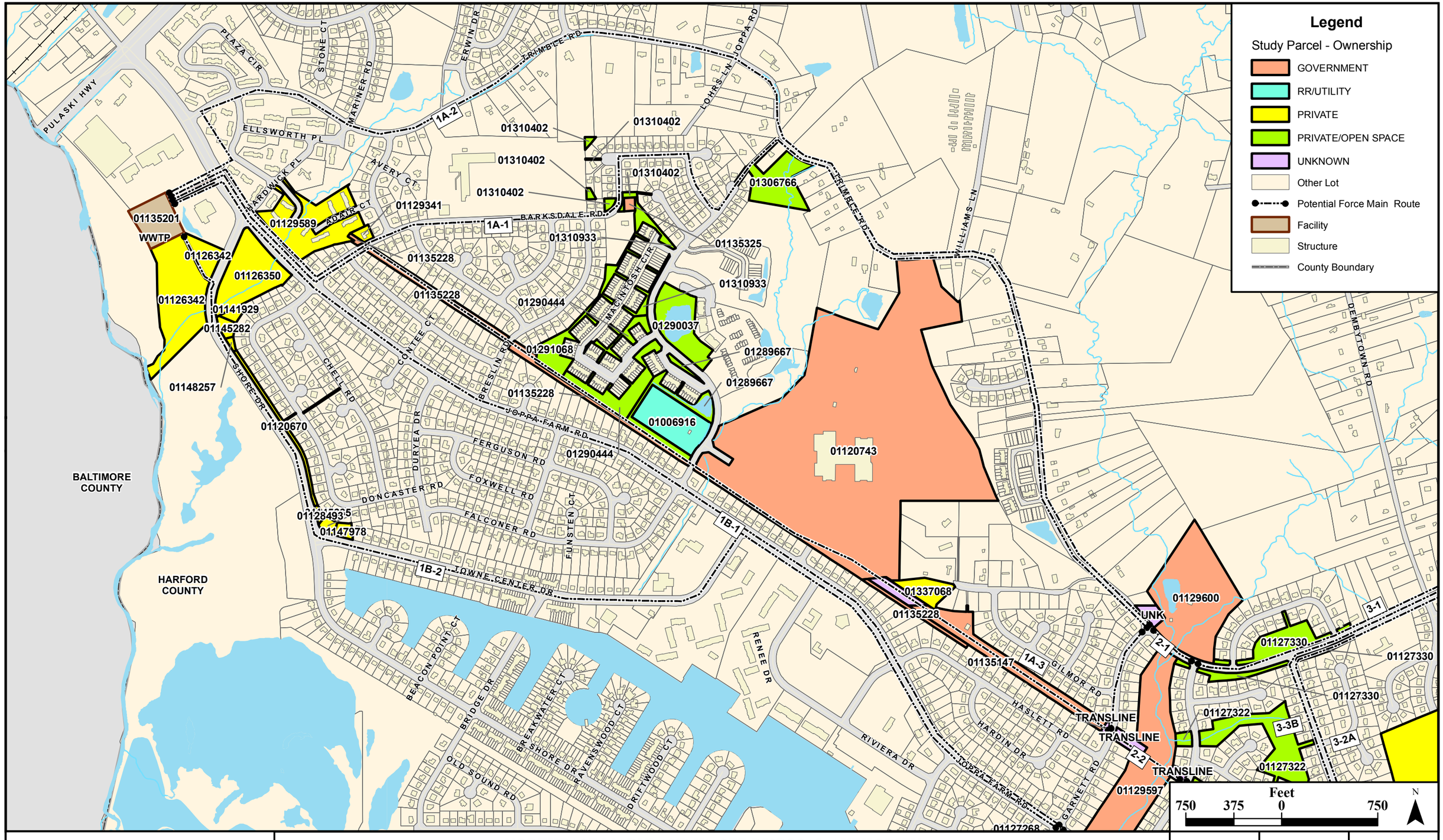

HDR | LMS	NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY STUDY PARCELS: JOPPATOWNE, HARFORD COUNTY, MARYLAND [WEST SECTOR]	Job No. 0067642 / Date 11/30/07 / Figure No. 2A

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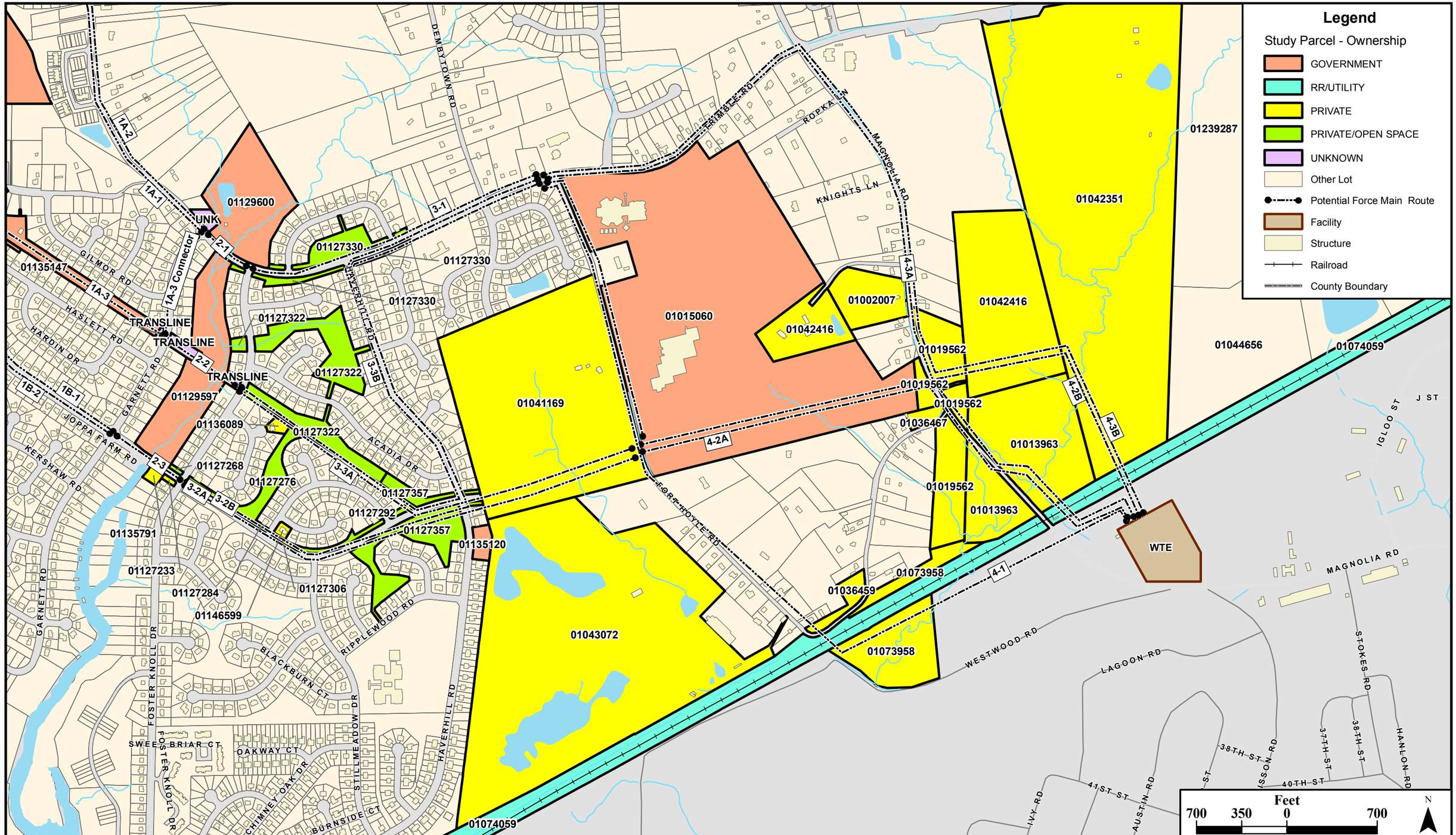

HDR | LMS	NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY STUDY PARCELS: JOPPATOWNE, HARFORD COUNTY, MARYLAND [EAST SECTOR]	Job No.	Date / Figure No.
		0067642	11/30/07 / 2B

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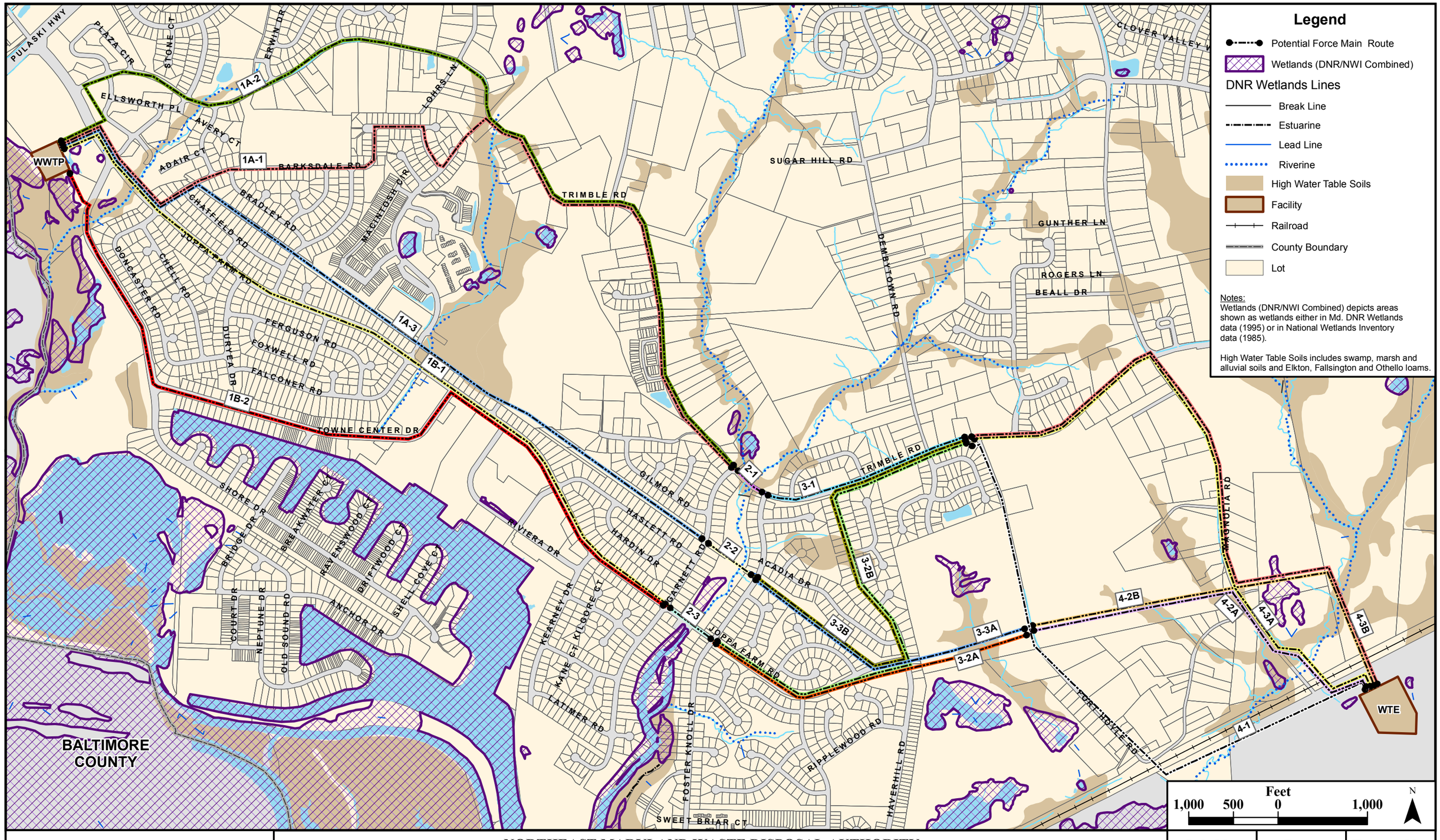

Legend

- Potential Force Main Route
- Wetlands (DNR/NWI Combined)

DNR Wetlands Lines

- Break Line
- Estuarine
- Lead Line
- Riverine
- High Water Table Soils
- Facility
- Railroad
- County Boundary
- Lot

Notes:
Wetlands (DNR/NWI Combined) depicts areas shown as wetlands either in Md. DNR Wetlands data (1995) or in National Wetlands Inventory data (1985).

High Water Table Soils includes swamp, marsh and alluvial soils and Elkton, Fallsington and Othello loams.

Feet
1,000 500 0 1,000
N

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NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY
TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY
WETLANDS AND HIGH WATER TABLE SOILS: JOPPATOWNE, HARFORD COUNTY, MARYLAND

Job No.	Date	Figure No.
0067642	11/30/07	3

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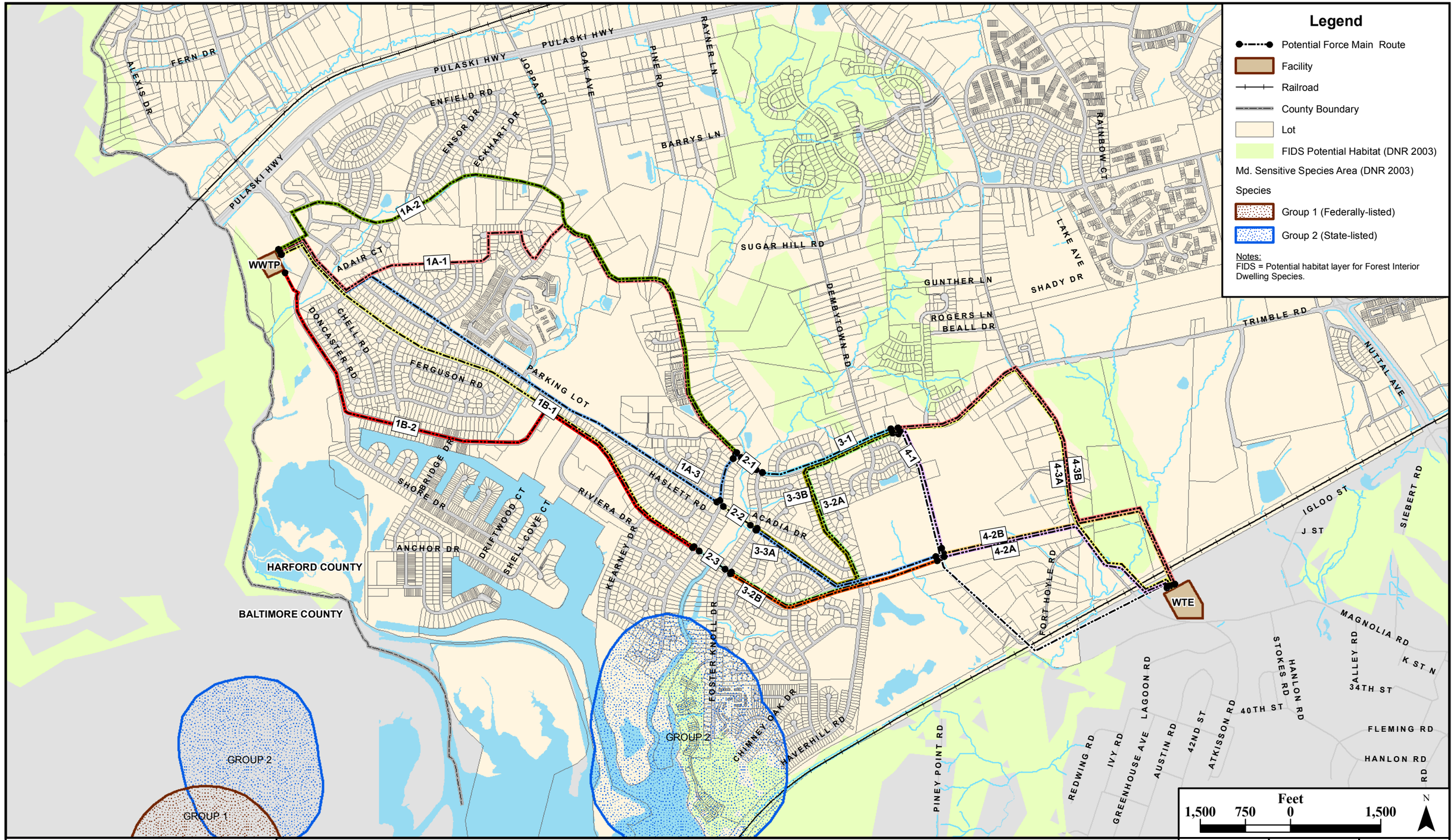

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NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY
TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY
SENSITIVE AND FOREST SPECIES: JOPPATOWNE, HARFORD COUNTY, MARYLAND

Job No.	Date	Figure No.
0067642	11/30/07	4

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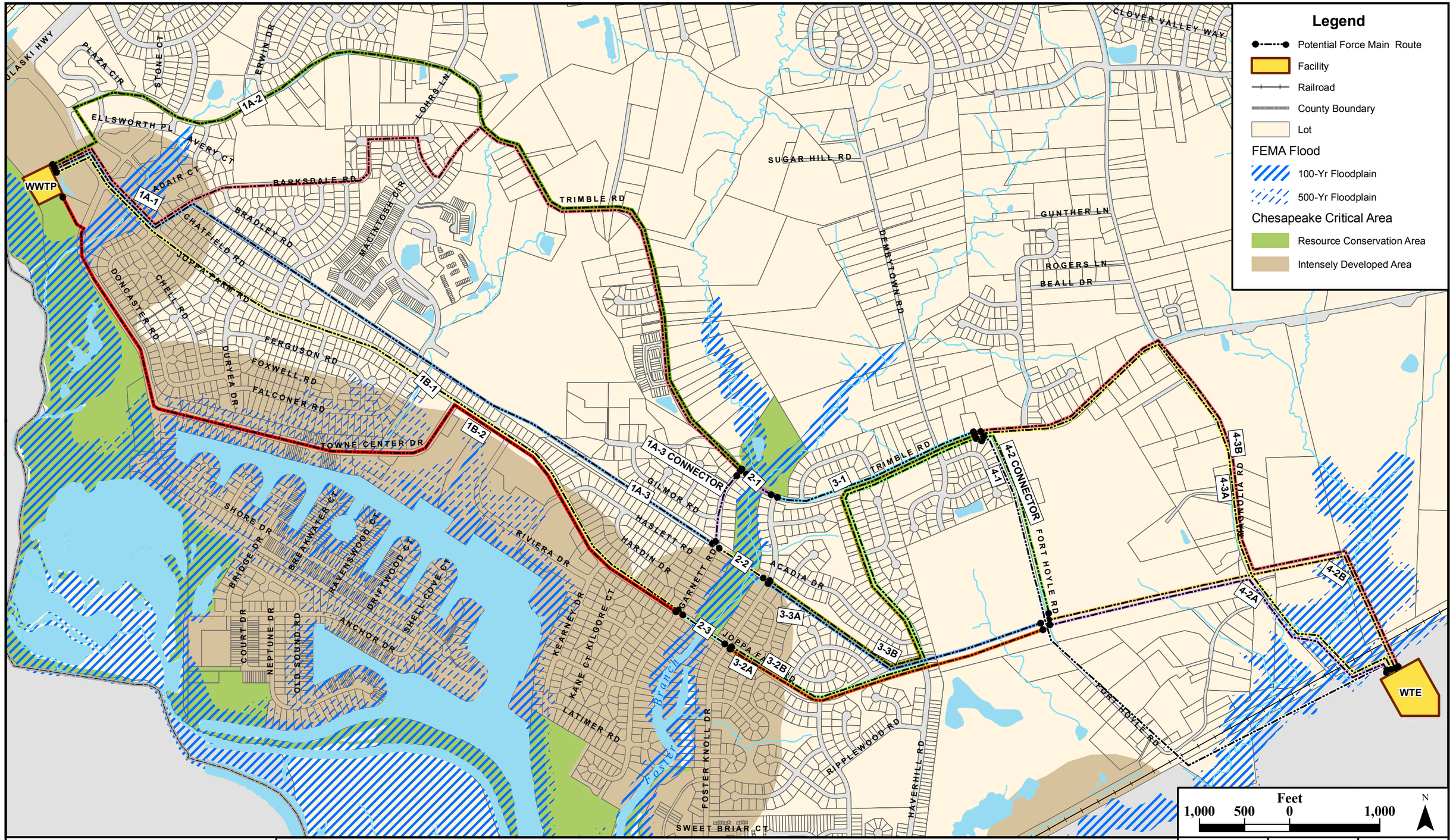

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NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY
TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY
FLOODPLAINS AND CRITICAL AREA: JOPPATOWNE, HARFORD COUNTY, MARYLAND

Job No.	Date	Figure No.
0067642	11/30/07	5

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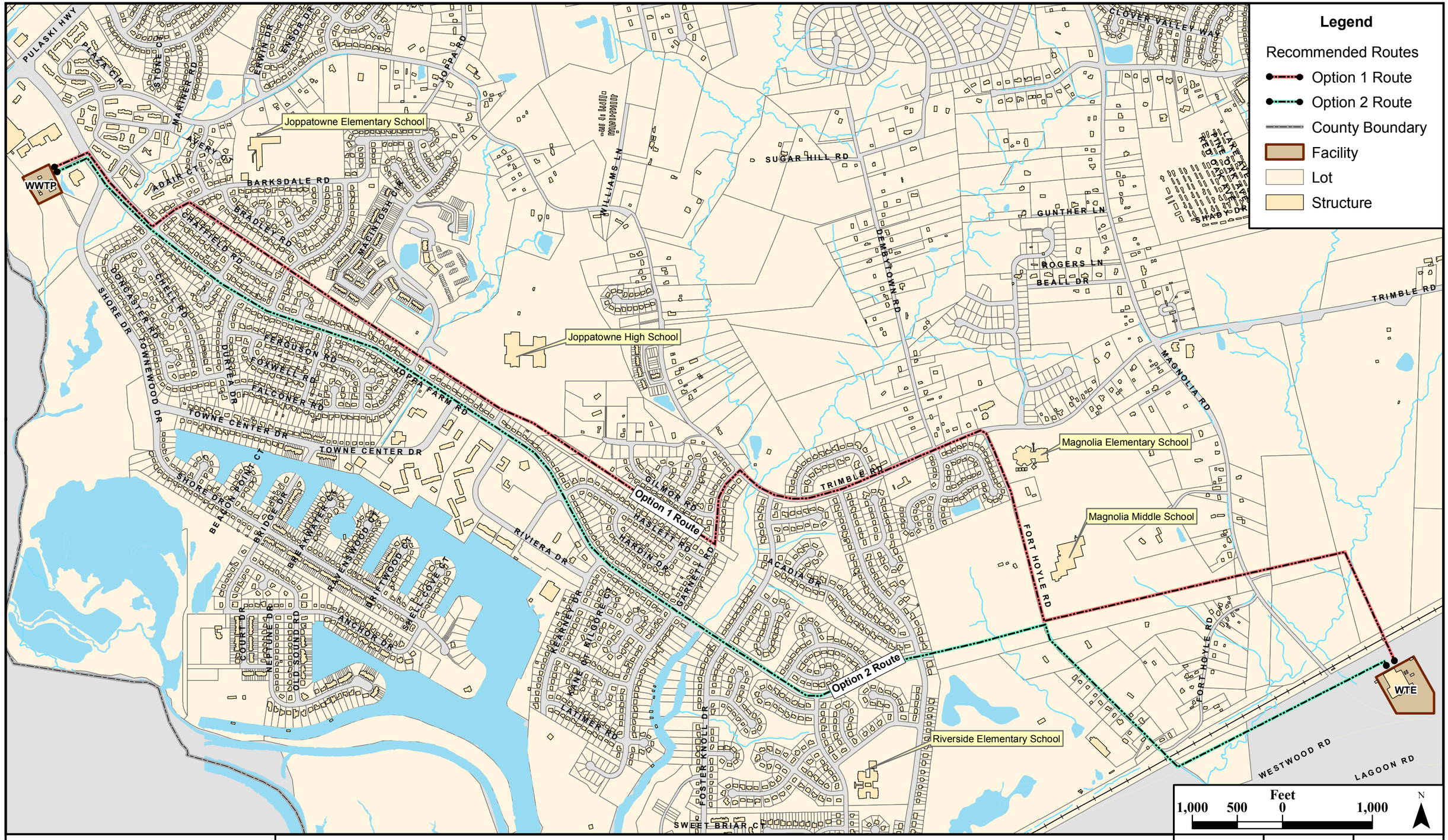

HDR | LMS	NORTHEAST MARYLAND WASTE DISPOSAL AUTHORITY TECHNICAL MEMORANDUM NO. 3 -- ROUTE ALTERNATIVE SUMMARY RECOMMENDED FORCE MAIN ROUTES: JOPPATOWNE, HARFORD COUNTY, MARYLAND	Job No. 0067642 / Date 11/30/07 / Figure No. 6

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