

Non-Technical Summary

Integrated Environmental and Social Impact Assessment, WHSD Central Section Construction

**Final Version** 

October 2011

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# Integrated Environmental and Social Impact Assessment, WHSD Central Section Construction

#### **Final Version**

14 October 2011

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Managing Partner ERM Eurasia, Moscow Office 14 October, 2011	

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ENVIRONMENTAL RESOURCES MANAGEMENT

# LIST OF ABBREVIATIONS

Abbreviation	Full name	
CJSC	Closed Joint Stock Company	
dBA	Decibel	
EBRD	The European Bank for Reconstruction and Development	
EIA	Environmental Impact Assessment (OVOS, Russian format)	
ESIA	Environmental and Social Impact Assessment	
GHG	Greenhouse gas	
JSC	Joint Stock Company	
MPC	Maximum Permissible Concentration	
MPC <sub>inst</sub>	Maximum One-time (Instantaneous) Permissible Concentration	
NGO	Non-governmental Organization	
PAP	Project-Affected People	
PCR	Public Compensation Receptions	
PEE	Public Environmental Expertise	
РРР	Public-Private Partnership	
PR	Performance Requirement (EBRD)	
RAP	Resettlement Action Plan	
RCF	Resettlement and Compensation Framework	
VOA	All-Russian Association of Automobile Owners	
WHSD	Western High-speed Diameter Motorway	
UNESCO	United Nations Educational, Scientific and Cultural Organization	

ENVIRONMENTAL RESOURCES MANAGEMENT

# 1 INTRODUCTION

This Project is aimed at the construction of the final segment of the high-speed toll motorway, i.e. the WHSD Central Section, which will connect the Northern and Southern sections of the WHSD motorway. The WHSD motorway will be an integral part of the Pan-European Transport Corridor IX, connecting Helsinki, St. Petersburg, Moscow, Kiev and South-European countries, and will improve the access to the Seaport of St. Petersburg and to the new Passenger Ferry Terminal on the artificial site constructed within the framework of the "Marine Facade" Project.

As of September 2011:

- The construction of the first segment, approximately 6 km long and part of the Southern Section, was completed and officially commissioned in April 2011;
- The construction of the second segment, approximately 2.7 km long and part of the Southern Section, was nearing completion;
- The construction of the third stage, the 26.2 km long Northern Section, was in progress.

The commencement of the WHSD Central Section construction is scheduled for 2012.

# 1.1 **PROJECT SPONSORS**

The European Bank for Reconstruction and Development (EBRD) is considering participating in the financing of the construction of the Central Section of the Western High-Speed Diameter (WHSD) and the subsequent operation of the entire WHSD motorway.

The borrower will be Company "OOO Magistral' Severnoj Stolitsy" (LLC Northern Capital Highway) within the framework of a Public-Private Partnership (PPP), which was selected in August 2011 following a competitive bidding process. The Partner Company will be responsible for the construction of the WHSD Central Section and then for the operation of the entire WHSD motorway.

# 1.2 NECESSITY AND OBJECTIVES OF THE PROJECT

Currently, the traffic intensity in the central part of St. Petersburg, in the streets leading to the city center, in the southern parts of the city, on bridges and along the embankments has reached a critical level. In addition, according to the assessments outlined in St. Petersburg's Urban Development Master Plan for the period until 2025, the high traffic intensity on the roads leading to the Seaport of St. Petersburg hinders the development of this highly important cargo transportation hub of Russia.

It is assumed that the WHSD motorway will relieve the road network within the central districts of the city protected by UNESCO and resolve the issues related to the traffic situation of the Seaport, on Vasilievsky Island and in the city's future business center – the Marine Facade area.

The construction of the WHSD motorway has the following objectives:

• Developing the access roads leading to St. Petersburg's Seaport;

- Concentrating major traffic streams on the high-speed motorway and linking of the main seaport, railway, air and motor traffic terminals with the network of regional roads;
- Linking the new passenger ferry terminal with the main destinations in the city;
- Creating transport connections between the north-western, central and southern districts of the city bypassing the city's historic center, thereby reducing the load on the streets and bridges in the central part of the city, alleviating traffic congestion, improving traffic safety, conserving architectural landmarks of global significance and substantially improving the environmental situation in the city.

# 2 DESCRIPTION OF THE PROJECT

# 2.1 HISTORY OF THE PROJECT AND ITS SIGNIFICANCE

A preliminary route of a future motorway designed to connect the northern and southern districts of St. Petersburg with the shortest possible distance, bypassing the city center and running near the Seaport was proposed in the general urban development plan of St. Petersburg as far back as 1966.

Implementation of the proposed plan was commenced in 1996, when a Project Design Development Plan for the construction of a new high-speed motorway was developed and approved by the St. Petersburg Committee for Urban Development and Architecture. The planned motorway was named "the Western High-Speed Motorway". In 2005 the RF Government took the decision (Resolution No.2005-r) to operate it as a toll motorway.

A Joint-Stock Company — "Western High-Speed Diameter" (JSC"WHSD") was established for the implementation of the Project. The motorway is planned to be operated on the basis of a Public-Private Partnership (PPP) between the city's Government, the JSC "WHSD" and a Partner Company.

Construction of the WHSD Central Section will start in 2012 and will last for 41 months.

# 2.2 BASIC ASPECTS OF THE FUTURE MOTORWAY ROUTE

The Central Section of the WHSD motorway will start right across the Ekateringofka River and end on the northern bank of the Bolshaya Nevka River (Figure 2.2-1). It will be 11.7 km long.

Approximately 60% of its length will consists of flyovers and bridges to be constructed above the Neva Bay water area, crossing Kanonersky Island and encompassing Bely, Vasilievsky and Krestovsky Islands at their western coast.

# 2.3 APPROVALS AND PERMITS FOR THE IMPLEMENTATION OF WHSD CENTRAL SECTION CONSTRUCTION PROJECT

The WHSD motorway was designed by a consortium of Russian companies headed by the "StroyProject" Institute. The Project design documentation was developed on the basis of the applicable Russian regulatory documents.

All required approvals from the relevant supervisory agencies and favourable conclusions from the State Environmental Review Department and the Main Project Review Department (*GlavGosExpertiza*) have been obtained for the Project design documentation for the WHSD Central Section construction.

# 2.4 CONSIDERED ALTERNATIVES

A preliminary corridor for all sections of the new motorway was delineated in 1966. Under conditions of densely populated residential areas, public buildings and existing transport infrastructure (railway lines and main streets), there were not many alternatives for the WHSD route.

#### *Figure 2.2-1 The WHSD Central Section Route*



The zero alternative was not considered with respect to the WHSD Central Section, because it is designed to connect the motorway's Southern and Northern Sections, which are already existing or being constructed.

In the process of the motorway design development the following alternatives were considered:

- Technical solutions related to structural bridge design, bridge/tunnel alternatives;
- Construction of the motorway segment along Vasilievsky Island at ground level or in a trench;
- Location and design of interchanges (including those planned to be constructed in the future);
- Structural materials for the roadway;
- Composition of auxiliary facilities and services (construction of those facilities was not included in the basic Project design).

#### 2.5 PUBLIC DISCUSSIONS OF THE PROJECT

In the process of the WHSD construction Project implementation the following measures were taken to ensure engagement with stakeholders:

- Public hearings in the process of the EIA preparation at the stage of the Feasibility Study in 1999-2000 (in the format envisaged by the Russian "OVOS" process);
- Public hearings on the materials of the 3rd Phase of the Project implementation (the Northern Section) in December 2006;
- Public Environmental Expertise (PEE) of the materials for the 3rd Stage of the WHSD construction (the Northern Section) performed by a public organization the St. Petersburg Society of Naturalists- and initiated by the non-governmental environmental movement "Save Yuntolovo" in 2006.

The WHSD construction Project was also discussed in public hearings related to other new facilities to be constructed in the city and held during the period of 2005-2010, such as discussions of St. Petersburg's Urban Development Master Plan (2005, 2007 and 2010), Land Use and Construction Plan of St. Petersburg (2008), Marine Facade Project including construction of hydraulically filled artificial sites.

Furthermore, the JSC "WHSD" has carried out regular actions aimed at maintaining interrelations with stakeholders on compensation payment and other issues related to the WHSD Motorway construction Project implementation.

# 3 CHARACTERIZATION OF THE PROJECT AREA

# 3.1 CLIMATE

The climate in the area of the Neva River mouth, within the Neva Bay and the coastal areas of the urban agglomeration of St. Petersburg is considered to be moderately cold, humid and transitional from marine to continental.

The maximum recorded air temperature is +34°C in July and the minimum recorded air temperature is -34°C in January. The average atmospheric precipitation rate is approximately 620 mm. The period with average daily temperatures above the freezing point is on average 218 days.

The snow cover can persist for 6 months. Sharp temperature changes from consistent frost to thaw periods and vice versa are a factor facilitating ice and glaze formation. The period with frosts lasts for 120 to 130 days; the ice thickness is normally 40cm to 50cm (maximum 70 cm).

The directions of prevailing winds in the region are westerly and south-westerly. The average annual wind velocity is 2.7 m/s. The maximum recorded wind velocity is 22 m/s.

# 3.2 AIR QUALITY

An analysis of existing data referring to the atmospheric air pollution during 2007-2010 suggests the following conclusions:

- The most problematic pollutant for the WHSD Project area is nitrogen dioxide, the concentrations of which on Vasilievsky Island already exceed the average daily permissible level by more than 50%;
- There has been a general trend toward improvement of the atmospheric air quality on Vasilievsky Island during the past four years.

In general, in comparison with other more polluted districts of St. Petersburg, the Neva Bay coast is the most acceptable area from the viewpoint of atmospheric air quality for the construction of a new motorway, although all possible measures are to be taken to minimize nitrogen dioxide emissions.

# 3.3 GEOLOGY

With respect to its geology and geomorphology, the area selected for the construction of the WHSD motorway is located within a lacustrine-glacial plain. The overall thickness of Quaternary sediments is 25m to 40m. Those deposits have a poor bearing capacity as a foundation for construction.

The underlying Proterozoic deposits are composed of consolidated clays. The clay roof has been found to be the most suitable formation as a base for piles for the future motorway.

Within the area of the WHSD Central Section construction the upper layers of soils/ bottom sediments contain virtually everywhere (both on the land and at sea) sediments and surface relief forms of man-made origin (filled soils on the land, fairways and underground soil dumps within the sea area). The sediments in the upper layers are partially contaminated.

#### 3.4 HYDROGEOLOGICAL CONDITIONS

For the hydrogeological conditions of the section from the interchange at the embankment of the Ekateringofka River to Kanonersky Island and on Kanonersky Island itself, a shallow groundwater layer (0.2m to 2.3m below the ground surface) is associated with the anthropogenic or lacustrine-marine and lacustrine-glacial deposits. The hydrogeological conditions of the Vasilievsky Island are quite similar to the initial part of the Central Section:

- Groundwater level at the western edge of the Island corresponds to the water level in the Neva Bay;
- These water are non-artesian;
- There is possibility that the upper horizon of the groundwaters in some parts is contaminated by oil products. The supplementary surveys need to be conducted to confirm it.

The groundwater layer may be hydraulically connected in some areas with the second (from the ground surface) aquifer occurring in sand lenses over the roof of the clay stratum (at depths of 28m to 35m). However, the water in that aquifer is generally confined; the head pressure is up to 26.0m.

# 3.5 HYDROLOGIC CONDITIONS

The WHSD Central Section will run through the eastern part of the Neva Bay along the boundary of the Neva River mouth (Neva Delta) with a network of natural tributaries (Bolshaya Neva and Malaya Neva, as well as Bolshaya, Srednaya and Malaya Nevka rivers), with relatively deep areas and man-made waterways, as well as extensive shoals of the Neva River mouth bar (Figure 3.5-1).

Periodic rise of the water level up to 3 m and more is characteristic for this part of the sea. To minimize the risk of floods, a flood protection barrier system has recently been completed and commissioned in St. Petersburg. After the barrier construction completion the rise of the water level is expected to be not more than by 2.3 m.

In winter, continuous ice cover is formed over water; movement of ice in the Neva River branches is reported in spring.

The entire eastern part of the Gulf of Finland, including the Neva Bay and the Neva River, is rated as a body of water of the **top fishery category** providing habitats and spawning grounds for smelt. Smaller waterbodies, such as the Smolenka River, are rated as Fishery Category 2.

# 3.6 RADIOLOGICAL SITUATION

According to the data obtained in the course of radiological surveys, the gammaradiation level of the surface soil layer within the WHSD Central Section corridor

complies with the natural baseline values characteristic of the unconsolidated deposits of the Neva River delta.

No final investigations have yet been conducted to study the radiological characteristics of the soils at the depth of possible groundwater migration from military camp No.6 (in the south-western part of Vasilievsky Island), which was found earlier to be a hazardous radiological facility.

The area crossed by the WHSD Central Section is considered to be radon-safe according to the sanitary zoning data.



Figure 3.5-1 Position of the WHSD Central Section with respect to the water bodies

ENVIRONMENTAL RESOURCES MANAGEMENT

#### 3.7 NOISE AND VIBRATION

In the historic center of St. Petersburg and along its main intracity traffic routes the noise levels exceed the regulatory limits, i.e. the equivalent noise level at daytime is as high as 68 dBA as compared with the sanitary norm of 55 dBA. As a result, a considerable part of the population of St. Petersburg lives in areas with high levels of noise pollution.

The residential areas on Kanonersky Island, which will be crossed by the new motorway, as well as the houses along the Marine Embankment on Vasilievsky Island are currently among the best districts in St. Petersburg with regard to the noise exposure level. The vibration impact levels comply with the regulatory norms.

#### 3.8 Soils

Virtually everywhere throughout the land allocated for the motorway construction, the natural fertile topsoil has been either disturbed of buried. "Urbanozem" (urbane soil) and other technogenic soil varieties have formed over filled ground.

In general, the current soil contamination level at the WHSD Central Section corresponds to the indicators of the overall soil contamination in St. Petersburg or is somewhat lower, with the exception of some individual areas with a higher degree of soil contamination. The maps indicating the location of such contaminated areas and their outlines have been lost.

Methane emissions are potentially possible from the buried soils, when they are exposed by drilling or excavation.

#### 3.9 TERRESTRIAL VEGETATION

There are some localized areas within the WHSD route covered with trees, shrubs or lawns. All this vegetation is of secondary nature and these areas do not have park status and are not officially recognized as recreational areas.

# 3.10 AQUATIC FLORA AND FAUNA

The Neva Bay area directly adjacent to the city of St. Petersburg is much less abundant in all hydrobiont components than other shallow waters in the Neva Bay. This is attributable to typical negative impacts of a large city. Additional adverse impact is caused by intensive construction of artificial sites and seabed deepening operations carried out in the eastern part of the Neva Bay (the yet on-going 4-year construction of the artificial site for the Marine Facade Project and waterways to the already completed passenger ferry terminal.

The ichthyofauna of the eastern part of the Neva Bay (including the Neva River mouth) is characterized by inconsistency in the size of populations, the fish biomass, species diversity and age composition. Most fish species use this area either for spawning or for the larva and hatchling stage of their development.

One of the spawning grounds is located directly at the edge of Krestovsky Island.

The maximum fish species diversity, population sizes and catches are recorded in June. The ichthyofauna of the subject area consists of 37 fish species, including some salmon species.

#### 3.11 BIRDS AND MAMMALS

The Neva Bay, despite significant anthropogenic pressure, plays an important role as one of the key sections of the waterfowl flyway between the White Sea and the Baltic Sea. This role is related to supporting the population sizes of a few tens of bird species nesting in the Russian Arctic and North-Western regions and wintering in Western Europe and Africa, as well as to biological diversity conservation.

However, due to the intensive development of the city during the past 20 years, the seasonal resting grounds of migrating birds have shifted significantly to the west of Bely, Vasilievsky and Krestovsky Islands.

The Yuntolovo nature reserve is located at a significant distance (over 4 km) from the WHSD Central Section. The WHSD Northern Section will run at a distance of 180m from the Yuntolovo reserve border.

No wild mammals living in or entering the construction zone of the WHSD Central Section have been reported during the recent years.

# 3.12 CURRENT LAND USE

The Western High-Speed Diameter motorway is located along its entire length within the current outlines of the city of St. Petersburg.

Within the *WHSD Southern Section*, the construction of which is nearing completion and which has been already partially commissioned, the area occupied by the motorway belonged earlier to the Baltic Railway Line right-of-way. This area included the following:

- numerous private garages, which were demolished prior to the commencement of the WHSD construction;
- residential and industrial areas, including the Kirovsky Factory's industrial area.

The WHSD Southern Section runs close to some cultural sites – the Kiryanovo mansion (about 30 m), the Putilovsky Temple and the Ekaterinhof Park (700 m).

# The WHSD Central Section starts from the end of the Southern Section and will run:

- across the site of the Seaport of St. Petersburg, within the railway line right-of-way, where 411 private garages are located, and across two land plots with warehouses owned by some external organizations;
- across the Marine Canal approximately 130 m wide;
- through the residential area of Kanoniersky Island;
- across the Neva Bay water area encompassing the western part of Bely Island;

- along the western edge of Vasilievsky Island, currently constituting an artificial canal. It is formed by the edge of Vasilievsky Island and the hydraulically filled site of the Marine Facade at a distance of about 60 m to the west;
- at a short distance (approx. 100m) from the abandoned Shkiperskaya dump site located in the south-eastern part of Vasilievsky Island;
- near the No.6 military camp, the site of which was assessed earlier as possibly hazardous in the radiological respect;
- along the residential area at Marine Embankment , which is located at a distance of 150m or more from the future motorway;
- across some unofficial recreational areas and a garage complex (for over 600 cars) on Vasilievsky Island;
- across the Petrovsky waterway (Malaya Nevka River);
- at the western end of Krestovsky Island, which constitutes a large recreational area with a sports center and with highly prestigious residential buildings in its eastern part;
- across the Srednaya and Bolshaya Nevka Rivers used by local residents for amateur fishing and for water-based recreation;
- the Central Section ends near the "Lenta" supermarket (Figure 3.12-1), where it joins the Northern Section.

*The WHSD Northern Section* will run for its first 5 km within a corridor between the residential districts and then between the residential and industrial areas on the western side and residential buildings on the eastern side. The motorway will cross three major roads connecting the Primorsky District and the center of St. Petersburg.

Next, the motorway will run through a forested area and enter into a rather narrow corridor between the residential district of Kamenka at its east and the Yuntolovo nature reserve at its west.

Then the motorway route crosses the Ring Road (its northern segment) and runs through urban forests and farming land (all this land within the motorway corridor has been already acquired and reclassified to the category of transport land).

The final section of the motorway crosses a residential area in the settlement of Beloostrov. There is a private dwelling house within the motorway route. The WHSD motorway ends with an exit to the federal highway "Scandinavia".



Figure 3.12-1 Current land use- WHSD Central Section

ENVIRONMENTAL RESOURCES MANAGEMENT FINAL VERSION NON-TECHNICAL SUMMARY ESIA-WHSD CENTRAL SECTION CONSTRUCTION

#### 3.13 SOCIOECONOMIC CONDITIONS

The WHSD Central Section route runs across the municipalities of Kirovsky, Vasileostrovsky, Petrogradsky and Primorsky districts.

The following specific socioeconomic features are typical of the above districts:

- Petrogradsky, Vasileostrovsky, Kirovsky and Primorsky districts account for more than one fifth of the total population of the city;
- Especially affected by the WHSD Central Section construction and operation will be the communities on Kanonersky Island and in the western part of Vasilievsky Island;
- The Municipality "Morskiye Vorota" (Kirovsky district, Kanonersky Island) has the following specificities: it is remote and isolated (insular) in relation to the city's center, it is industrial in character and has poorly developed social infrastructure, as well as dilapidated housing. According to the long-term plans at federal and local levels, Kanonersky Island should become part of the Big Seaport of St. Petersburg, which would rule out further existence of housing ;
- The western part of Vasilievsky Island is densely populated with numerous residential areas constructed after the 1960s and a well-developed social and service network. This area currently has limited accessibility and unfavorable climatic conditions (high air humidity and open to winds from the Baltic Sea), and is predominantly inhabited by mid-income households;
- Most of the socioeconomic indicators of Petrogradsky, Vasileostrovsky, Kirovsky and Primorsky districts coincide with the level and trends typical of the entire city.

#### 4 SITE SELECTION AND PLANNING RESTRICTIONS

The WHSD Central Section planning and construction should be carried out with due consideration of the limitations related to the following areas:

- Water protection areas of the river branches in the Neva Delta and the Marine Canal;
- Architectural, urban development and technical design limitations;
- Areas of general, potable and recreational water usage;
- Fishery categories of the water bodies.

The limitations listed above and the pertinent requirements to protection status of such areas have been taken into account in the process of the Project design development. No other site selection and layout limitations having an influence on the project implementation have been identified.

# 5 PROJECT DESIGN

# 5.1 GENERAL DESCRIPTION OF TECHNICAL SOLUTIONS RELATED TO THE WHSD CENTRAL SECTION

# **Technical Parameters**

Road category: main high-speed motorway.

Design traffic speed: 120 km/hour (with a speed limit of up to 80 km/hour at curves).

Number of lanes: 8 (4 lanes in each traffic direction).

The roadway width for each direction at straight road segments: 14.5 m; the roadway width is increased at interchanges and at curves. No sidewalks for pedestrians are planned.

# Motorway Layout and Longitudinal Profile

Based on the motorway's plan and longitudinal profile elaborated in keeping with the above factors, the following basic technical solutions were adopted for the Project:

- Construction of a two-level flyover from the Ekateringofka River to the Neva Bay coast behind Kanonersky Island;
- Maximum height of the flyover at the bridge across the Marine Canal (45m above sea level);
- Crossing all waterways by bridges complying with the pre-determined underbridge clearance for navigation;
- Gradual change from two-level to single-level design in the range of Bely Island;
- Lowering of the motorway level behind the bridge across the Korabelny waterway from the flyover to an embankment and then into a trench;
- Construction of the motorway stretch along the Vasilievsky Island coastline in an open trench partially covered by driveways and footways;
- Construction of a tunnel under the Smolenka River;
- Exit of the motorway at the north-western end of Vasilievsky Island from the trench to an embankment and then to a flyover;
- Construction of the motorway stretch from Vasilievsky Island to the end of the Central Section as a single-tier flyover.

# **Road Pavement**

Several types of road pavement will be used:

- The roadway on span structures with a steel plate at its base will be coated with two layers (each 45mm thick) of cast asphalt concrete over hydraulic insulation;
- The roadway on span structures with a reinforced concrete slab at its base will be coated with two layers of asphalt concrete of different grades (40mm thick lower layer and 70mm thick upper layer);
- The roadway on the cable-stayed bridge with a reinforced concrete slab will be paved with two layers (each 45 mm thick) of cast asphalt-concrete;

- The roadway in the trench along Vasilievsky Island will include two base layers (asphalt-concrete over crushed stone) 56 cm thick and two coats of pavement (asphalt-concrete of different grades) 12 cm thick;
- On embankments the lower base layer will be thinner and constructed using a different technology and a different grade of crushed stone, but it will be underlain by an additional roadbed layer and a layer of sand.

*Runoff drainage from the roadway* will be ensured via open launders to be constructed at the right and left sides of the roadway. Stormwater runoff from flyovers, bridges and the tunnel will be drained by gravity to onsite stormwater treatment facilities. There will be 14 onsite treatment facilities incorporated in the WHSD Central Section.

# Ancillary Engineering Facilities

The WHSD Central Section is planned to incorporate the following engineering facilities: four exit ramps to Makarov Embankment and two exit ramps to Ekateringofka Embankment, four driveways above the WHSD motorway on Vasilievsky Island, a new streambed (in a concrete launder) for the Smolenka River above the tunnel, a toll collection terminal at the exit to Ekateringofka Embankment, an underground engineering facility under the tunnel on Vasilievsky Island, and transformer substations.

A technological road with asphalt-concrete pavement will be provided along the WHSD route at the side of Vasilievsky Island, as well as sidewalks with crushed stone coating for pedestrians.

In addition, the Project provides for the following support and auxiliary facilities:

- Automated traffic control system;
- Information boards above the roadway;
- Installation of road guards, road signs, roadway markings; Lighting of the motorway and exit ramps;
- Anti-icing systems on bridges and on the road stretch in the open trench.

# 5.2 KEY PROJECT STAGES

# Preparation of Construction Sites

The St. Petersburg Government is responsible for preparation of the construction sites, including the following:

- Financing and implementation of removal/relocation of any pipelines, underground and overhead cable lines located currently within the motorway route;
- Removal of buildings and structures from the construction sites, including apartment buildings and a kindergarten (Kanonersky Island), garages (Seaport area and the area of the interchange in Makarov Street); resettlement of residents living in municipal apartments or monetary compensation for privately owned apartments/garages;
- Coordination with the Marine Facade Project to ensure optimal conditions for the WHSD construction (in compliance with the construction time schedule and elevation parameters of artificial sites at the western side of the future motorway);

• Arrangements for the investigation of the right-of-way area to identify any potential unexploded ordinance and their destruction, if detected.

The Partner will be responsible for the following issues and aspects:

- Elaboration of the final Project design documentation based on existing design and obtaining the approval of relevant supervisory agencies;
- Obtaining a Construction Permit in its own name;
- Clearing of trees and shrubs within the final right-of-way outlines;
- Removal and safe disposal of soils affected by historic contamination;
- Stripping and stockpiling for provisional storage of fertile topsoil, which can be used for subsequent land reclamation, provided that its chemical composition permits it;
- Preparation of construction sites and construction of provisional roads;
- Construction of a provisional flyway over the Neva Bay and piling of temporary small islands for construction of piers for the future motorway.

The final elevations of the Marine Facade sites along the western WHSD right-of-way line should be at least 2.9m and the elevation of the temporary islands should be at least 2.5 m. This will rule out flooding of the above sites/islands in case of possible high water levels (taking consideration of the recent commissioning of the flood barrier system of St. Petersburg, which limits water rise to 1.6m above the level of the Baltic Sea).

# Supply of Construction Materials and Structures

Sand and stone for piling of temporary islands, as well as crushed stone and sand for road construction in the trench and on embankments will be delivered from licensed quarries operating in Leningradskaya Oblast.

Asphalt and concrete mixture will be manufactured at plants in St. Petersburg.

# Preparation of Temporary Construction Sites and Construction of Temporary Roads

The current project design envisions that there will be 16 temporary construction sites occupying a total area of 15.7 ha, required for the reception of construction materials and structures for the WHSD Central Section construction. They will accommodate storage and auxiliary facilities, utilities and amenities for construction personnel, parking and maintenance areas for vehicles and machinery. Concrete mixing plants will be installed at two sites to support the tunnel construction.

# Temporary Flyovers and Islands

The current project design envisions that provisional flyovers will be constructed for piling small temporary islands in the Neva Bay water area and for the delivery of machinery and materials to those islands. The overall area of the temporary islands to be constructed in the Neva Bay water area will be 31.2 ha (Figure 5.2.1).



Figure 5.2-1 Temporary islands to be constructed in the Neva Bay water area

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#### Covered Trench under the Smolenka River

The tunnel (or more precisely covered trench) will be constructed in an open trench. Prior to the construction commencement, the southern Smolenka river branch will be blocked. The tunnel construction will be commenced in the central part of the tunnel, where later a new permanent Smolenka streambed will be constructed. The construction will proceed toward the southern tunnel portal.

The wall of the covered trench will be 1.0 m thick. Soil excavation will be carried out by layers with reinforcement of the excavated pit. After the design elevation of the pit bottom is reached, it will be graded and a hydraulic liner will be installed on the bottom. The top of the tunnel will be also hydraulically isolated.

#### **Construction Organization and Time Schedule**

The construction is planned to be carried out in three shifts. Within the areas located close to residential areas, construction will be carried out in two shifts, with a break from 11:00 PM until 07:00 AM. The total duration of the construction phase will be 41 months.

# 6 ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

# 6.1 IMPACTS ON SOILS AND LAND RESOURCES

# 6.1.1 Main Adverse Impacts on Soils and Land Resources

- The total area of land needed for WHSD Central Section construction is 35.85 ha, including 4.4 ha of land for temporary facilities to be used during the construction phase. This does not take into account 66.1 ha of land, allocated by the city to the "TerraNova" Company, which belonged earlier to the water fund, for construction of the Marine Facade Project;
- Stripping of fertile topsoil layer;
- Potential secondary environmental pollution in the process of excavation/ drilling of historically contaminated soils;
- Possible environmentally significant impact during the motorway operation caused by possible wind and water erosion, contamination with stormwater and snow-melt water, migration of anti-icing agents to soils, leaks and accidental spills of chemicals in the process of their transportation.

# 6.1.2 Mitigation Measures for the Protection of Soils and Land Resources

In order to prevent any damage to land resources during the WHSD Central Section construction phase the following mitigation measures will be taken:

- Stripping and separate stockpiling of uncontaminated arable topsoil layer suitable for further use;
- Compulsory removal/decontamination of soils with hazardous or highly hazardous degree of contamination or their disposal in landfills for industrial waste;
- Complete covering of the ground surface in temporary accommodation camps for construction workers, as well as access roads to them, with concrete slabs to avoid infiltration of pollutants into the ground;
- Complete covering of soil and proper equipment of parking and fuel filling areas for machinery and vehicles to prevent migration of petroleum products into the ground;
- Land reclamation measures to restore disturbed soil areas and their revegetation.

To prevent potential adverse impact on soils during the WHSD operational phase, the following measures have been planned:

- reinforcement of the roadbed slopes to avoid and minimize erosion (along the short road segments running on embankments);
- stormwater runoff drainage systems with appropriate treatment facilities, including head tanks capable of containing any volume of hypothetically possible spills of chemicals on the motorway; Volumes of head tanks vary from

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800 to 2200 m<sup>3</sup>, because their main purpose is to collect stormwater before treatment from the parts of the road with various length.

• application of mechanical means (sand and gravel mixtures) rather than chemical ones to prevent icing and avoid contamination of the soils in adjacent areas.

#### 6.2 IMPACTS ON GEOLOGICAL CONDITIONS

The applicable civil engineering regulations and technologies will be complied with, and as a result no significant impacts upon the geological environment and topography are anticipated, whether during construction or operations.

#### 6.3 ATMOSPHERIC AIR QUALITY

The following impacts on atmospheric air quality are expected during the construction phase:

- Low level of pollution (up to 0.1 of the regulatory one-time MPC<sub>inst</sub> value) will be typical with regard to carbon black particles and nitrogen dioxide. The contribution of the construction machinery to polluting the atmosphere with carbon monoxide will be negligible, i.e. max. 0.03 of the MPC<sub>inst</sub> value.
- Contamination of the atmosphere with particulate matter in the process of foundation pit excavation is expected not to exceed 0.15 MPC<sub>inst.</sub>;
- Taking into account the baseline pollution levels, the maximum one-time concentrations of nitrogen dioxide will not exceed 0.9 MPC<sub>inst.</sub> on Kanonersky Island and 0.8 MPC<sub>inst.</sub> on Vasilievsky Island.

Thus, no risks of atmospheric air pollution from the viewpoint of public health have been identified for the construction phase.

During the operational phase the following impacts on the atmospheric air quality are expected:

- A short-term non-compliance (not longer than during 70 hours per year) with the regulatory MPC<sub>inst</sub> value for nitrogen dioxide is predicted for the motorway segment along the western edge of Vasilievsky Island at the time of the motorway commissioning near the residential buildings located at a distance of 150 m from the motorway;
- In the future, i.e. by 2020-2022, it is expected that the ambient air quality in the residential area adjacent to the WHSD motorway will improve after the use of fuel of Euro 2 and 3 Classes is prohibited and environmentally safer fuel is used;
- Concentrations of other pollutants in atmospheric air will consistently comply with the respective regulatory maximum permissible levels;
- Commissioning of the WHSD Central Section will partially relieve the traffic situation in the city's historic center and a positive change in the ambient air quality can be expected there.

In order to abate the negative impact on atmospheric air due to elevated nitrogen dioxide concentrations, it is recommended that an automated monitoring system be set

up along the WHSD motorway on Vasilievsky Island to monitor nitrogen dioxide concentrations. The monitoring data should be used to take appropriate decisions with regard to traffic control during periods with adverse weather conditions unfavorable for pollutants' dispersion in the atmosphere (speed limits/ limitation of the traffic streams/temporary prohibition of traffic of vehicles with engines of lower environmental classes).

#### 6.4 GREENHOUSE GAS EMISSIONS

Due to optimal traffic streams and traffic conditions, as well as reduction in the distances travelled by vehicles using the WHSD motorway, it is expected that the overall fuel consumption in the city as a whole will decrease and the resulting reduction in the carbon dioxide emissions is estimated at approximately 50,000 t/year.

- 6.5 NOISE AND LIGHT
- 6.5.1 Noise

# **Construction** Phase

The maximum noise impact will be imposed in the process of drilling boreholes for pile foundations on Kanonersky Island and the construction of the Smolenka covered trench on Vasilievsky Island. In the course of this work the following noise exposure levels are expected:

- It is expected that in residential areas on Kanonersky Island adjacent to the construction sites the permissible noise exposure level (55 dBA) will be exceeded by up to 16 dBA with regard to the maximum value and by up to 29 dBA with regard to the equivalent noise level;
- On Kanonersky Island the noise will affect at least seven residential buildings, the residents of which are not planned to be resettled, as well as School No.379 and the Customs Office building located within the area where the noise level will exceed the regulatory permissible limit;
- For the residential buildings located in the first line on the Marine Embankment on Vasilievsky Island, the noise level during the construction phase will exceed the regulatory limit.

To reduce the noise exposure in the residential areas adjacent to the construction sites, the Project design provides for the following measures:

# On Kanonersky Island:

- Resettle the residents of Houses 15 and 17, two sections in House 12/Building 2 and three sections in House 16;
- Close the kindergarten in House 20 and construct a new kindergarten at an appropriate distance from the WHSD route;
- Install sound-proof window frames in three residential buildings with passive ventilation reducing the noise level by 38 dBA;
- Construct fencing made of concrete slabs 3m high at the construction camp located near House 12/Building 2.

At the Marine Embankment on Vasilievsky Island:

• Prior to the construction commencement install soundproof glazing at the façades of the residential buildings facing the Marine Embankment (to reduce the noise exposure level by 32 dBA);

In addition to the measures foreseen in the Project design it is recommended to:

- Use advanced technology with low sound levels;
- Consider the possibility to limit construction activities involving the use of construction machinery in the vicinity of residential areas to the period between 08:00 AM and 09:00 PM;
- Increase the number of houses on Kanonersky Island where the windows are to be replaced and install soundproof windows in the buildings of the No.379 School and the Customs Office - the final decision should be made based on the results of the Project design documentation.

# Motorway Operation

- It is expected that the noise exposure level in the residential area on Kanonersky Island adjacent to the motorway will exceed the permissible limit, mainly in the yard of the No.379 School;
- To ensure compliance with the regulatory noise exposure limits, it will be required to reduce the noise level by 13-23 dBA in the yards of the residential buildings and by 27 dBA on the playgrounds near the school;
- On Vasilievsky Island the noise exposure level on residential premises (after the window replacement during the construction phase) and on the playgrounds for children in residential areas is expected to comply with the regulatory norms;
- The noise exposure level in the future promenade zone to be created to the west of the WHSD motorway on the Marine Facade site should comply with the regulatory norms after the implementation of additional noise mitigation measures described below.

The following measures aimed at reducing the expected negative noise impact have been outlined in the Project design:

Kanonersky Island:

• Installation of an acoustic screen 3 m high and 650 m long at the right side and the left side of the motorway in the area of Kanonersky Island;

In addition to the measures described in the Project design, it is recommended to the Partner to consider and study the following possibilities:

 extend the soundproof screens along each motorway tier from Kanonersky Island toward the Neva Bay for a further 300 m. In this case the noise level throughout the entire residential area (taking into account the planned resettlement) and in the No.379 School yard would be very close to the levels prescribed by the applicable sanitary and hygienic norms - the final

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decision should be made based on the results of the Project design documentation.

#### Vasilievsky Island:

- The noise exposure level at the facades of the buildings facing the motorway will be 63-75 dBA during daytime and 56-68 dBA at night. However, inside residential buildings after the replacement of the windows it will comply with the applicable sanitary norms;
- Inside the residential blocks protected by tall buildings against the noise exposure from the motorway, the noise exposure levels are expected to be in the order of 40-50 dBA, i.e. in compliance with the sanitary norms. The expected exceedance of the sanitary norm by 1 to 2 dBA on the playgrounds of the kindergartens will be easily corrected by existing fences around the kindergarten sites.

Measures aimed at mitigating the identified negative impacts:

- To ensure acoustic comfort on all indoor premises the windows which face the Marine Embankment, it is foreseen in the Project design to install soundproof windows with a sound insulation efficiency, R<sub>Atran</sub>, of at least 33 dBA.
- To ensure compliance with the noise level norms in the future promenade area, a 4 m high continuous acoustic screen will be installed at the left side of the main direction of the motorway.

It may be, therefore, concluded that the proposed additional noise abatement measures and those foreseen in the Project design will make it possible during the WHSD operational phase to:

- ensure compliance with the regulatory noise level limits in the apartments on Kanonersky and Vasilievsky Islands;
- ensure compliance with the regulatory noise level limits in yard areas adjacent to the residential zones on Kanonersky Island (including the area in front of the school building) and in the future promenade zone on the Marine Facade site.

Elevated noise level will be representative of the areas eastward of the WHSD route, where installation of the acoustic screens will not take place. Along with this, the yards of the existing residential buildings facing the WHSD, will be affected to the elevated noise level.

#### 6.5.2 Illumination and Vibration

No negative impact related to illumination is expected during the motorway's operational phase. Sound-proof screens, high elevations of flyovers or construction of a motorway segment in a trench will protect the residential areas on Kanonersky and Vasilievsky Islands against the penetration of light flux.

There are no residential areas in the vicinity of the interchange on the Ekateringofka Embankment and no negative impact related to illumination possible. Regarding the

interchange on the Makarov Embankment, design of the interchange's inclines excludes the direct light flux from automobiles to the residential buildings.

The other segments of the WHSD Central Section will run at a considerable distance from any residential areas.

According to the results of monitoring conducted at the construction stage of the Southern and Northern Sections and the operation stage of the Southern Section, the zones with elevated vibration located at 10m distance from the construction/operation areas are not identified.

#### 6.6 USE OF WATER RESOURCES AND IMPACT ON SURFACE WATERS

#### 6.6.1 Use of Water Resources during the Construction and Operational Phases

The following main impacts related to water requirements and wastewater management are expected during the construction and operational phases:

- Use of water resources for general, sanitary and industrial needs;
- Potential environmental impact associated with discharge of stormwater runoff, sanitary wastewater treatment and drainage water.

Water needs during the motorway construction and operational phases will be rather low; water will be supplied from the municipal water supply networks. Certified bottled drinking water will be delivered to the personnel.

During the *construction phase*, all types of wastewater generated at the provisional construction camps will be collected, removed and treated in accordance with the procedures foreseen in the Project design.

In addition, the following measures will be required during the construction phase:

- Pumping of drainage water from foundation pits excavated on Vasilievsky Island for motorway construction in a trench and in a tunnel. These water streams will be sent to onsite treatment facilities and discharged after treatment to the municipal stormwater drainage networks.
- Pumping of drainage water from foundation pits excavated on temporary islands around pile foundations and its discharge without treatment to the Neva Bay. The suspended matter content in this water can be rather high and the overall volume of discharged drainage water will amount to a few tens of thousands of cubic meters. The Project design does not provide any technical solutions for treating this drainage water stream.

It is recommended that appropriate technical solutions be defined and documented at the development stage of the elaboration of the Project design documentation to eliminate any discharge of potentially contaminated water from the foundation pits on the temporary islands to the Neva Bay.

During the *operational phase* of the WHSD motorway, stormwater runoff from the entire WHSD Central Section will be collected and treated at 14 onsite treatment

facilities; treated stormwater will be discharged either into the municipal stormwater runoff drainage networks or directly into the Neva Bay.

However, the experience of operating similar treatment facilities at the WHSD Southern Section has shown that the concentration of petroleum hydrocarbons (in the order of 0.10 mg/l) does not meet the compulsory criteria for release directly into the Neva Bay, which is rated as a water body of top fishery category. The Partner Company will have to install an additional final treatment unit at the treatment facilities to ensure that the petroleum hydrocarbon content of treated water at the outlet to the Neva Bay will not exceed 0.05 mg/l.

Furthermore, special attention should be paid to assessing the risks of constructing onsite treatment facilities for the motorway segments between Kanonersky and Vasilievsky Islands. They are planned to be constructed on new hydraulically filled sites, but the question when and who will construct those sites still remains unclear.

#### 6.6.2 Impacts on Surface Waters

The construction phase will have the following main types of impact on surface water bodies:

- Formation of areas with an elevated degree of water turbidity in the Neva Bay. As a result of sand filling in the process of construction of temporary islands the water turbidity will increase over a water area of 58.6 km<sup>2</sup> by a value of 0.25 mg/l, 24.9 km<sup>2</sup> by over 10 mg/l, 6.4 km<sup>2</sup> by over 50 mg/l and 2.8 km<sup>2</sup> by 100 mg/l;
- Sliming of bottom sediments as a result of piling the temporary islands it is expected that settling suspended matter will form a layer more than 5 mm thick over an area of 4.7 km<sup>2</sup> in the Neva Bay (this means that the conditions for the existence of the benthos within that area will be negatively and significantly affected);
- Changes in hydrologic conditions (and especially conditions for ice movement) as a result of the construction of temporary islands;
- Possible formation of ice dams in the streambeds of the Neva River branches as a result of the construction of temporary islands.

To minimize negative impacts, the Project design foresees that the procedure for the construction of temporary islands in the Petrovsky waterway will start with sheet piling along the outlines of a planned island followed by sand filling; this procedure will virtually rule out entrainment of fine sand fractions to the Neva Bay.

However, for all other temporary islands to be constructed no significant measures to minimize entrainment of fine sand fractions to water has been foreseen in the Project design. The consequences of significant blocking of the streambeds of the Neva River branches with temporary islands have not been assessed in the Project design, especially for periods of ice movement. Regarding this problem, the following steps are recommended in addition to the measures planned in the Project design:

- In the process of the elaboration of the Project design documentation, the technology for construction and subsequent removal of temporary islands should be modified. A possible environmentally efficient technique could be to fill the perimeter of a future island with gravel or bags of sand with subsequent filling of the internal space with sand ("atoll principle"). The removal of the islands should proceed in the reversed order.
- Additional studies and hydrodynamic modeling should be conducted to predict formation of ice dams in narrowed parts of the Neva riverbed. Based on the modeling results, it is required to define recommended measures to ensure unobstructed ice movement and prevent drifting of ice on to the coastal zone in the construction area.

#### 6.7 IMPACTS ON GROUNDWATER

The construction and operation of the flyover segments of the WHSD Central Section will not have any significant impact on groundwater levels in the areas adjacent to the motorway. The following measures will be taken on Vasilievsky Island:

- Installation of a drainage system from the WHSD motorway with release of pumped water to the municipal stormwater sewer networks;
- Artificial (by means of cutting off the top of the covered trench wall) drainage of groundwater under the tunnel through a bed of coarse-grain sand.

No deterioration of the chemical composition of groundwater is expected in connection with the WHSD construction and operation, because:

- During the construction stage, all activities with chemicals (primarily filling the stationary machines and mechanisms) will be implemented by the retention structures, such as special bottom plates and moistureproof trays with raised edges;
- During the operational stage, the system of stormwater collection will detect and accumulate the spilled water on the road into the tanks that are the parts of the WHSD watertreatment facilities.

It is important that, groundwaters located within the WHSD route, are used neither for drinking and nor balneological purposes.

#### 6.8 WASTE MANAGEMENT

Waste will be generated in the process of the Project implementation during the preparation of the construction sites and during the construction and operational phases.

The following types of waste will be generated during the construction phase:

• Contaminated and excess soils removed from the construction sites (approx. 2,270,910 t or 87.6% of the total amounts of construction waste);

- Construction-grade crushed stone not suitable for further use (107,390 t or 4.1% of the total amounts of construction waste);
- Broken reinforced concrete structures (57,880 t or 2.2%).

The proportion of other waste types will not exceed 1% of the total amount.

The following types of wastes will be generated during the operational phase:

- Spent bulbs and tubes containing mercury used for motorway illumination;
- Residue from the treatment of stormwater runoff from the motorway;
- Spent filtering material used for the treatment of stormwater runoff from the motorway;
- Contaminated snow from the motorway in winter;
- Contaminated snow (removed from the roadway in winter);
- Sweepings from the motorway during warm seasons;
- Domestic waste from the dispatcher centers and toll collection terminals.

In general, it is expected that about 37,800 tonnes of waste will be generated annually in the process of operating the WHSD Central Section. Contaminated snow will account for a major part of generated waste, i.e. 90% of the total waste amount (in terms of weight), followed by sweepings (6%) and residue from the on-site stormwater treatment facilities (3.8%).

Most types of waste will be managed by contractor organizations commissioned to perform cleaning/repairs of the motorway and associated infrastructure facilities.

Some waste will be removed promptly from the sites as soon as they are generated, without the need for temporary storage (during the construction phase: soil, waste of asphalt concrete, reinforced concrete and concrete waste, bulky steel structures, waste of crushed stone; during the operational phase: street sweepings). Short-term storage of waste will be performed in specially designated and properly equipped areas on the land allocated for the WHSD Central Section construction).

The experience of JSC "WHSD" gained in the process of the WHSD Southern Section construction and operation indicates that necessary conditions exist for the organization of an efficient waste management system by the future Partner Company.

#### 6.9 BIODIVERSITY CONSERVATION, TERRESTRIAL ECOSYSTEMS

# 6.9.1 Impacts on Land Vegetation during the Construction and Operational Phases of the WHSD Central Section

The following types of impacts have been identified in the process of the impact assessment of the WHSD Central Section construction Project.

#### **Direct impacts:**

• Clearing of trees (967 trees, 2,763 m<sup>2</sup>) and shrubs, stripping of lawns (over an area of 142, 875 m<sup>2</sup>) within the motorway corridor and at temporary facilities;

#### Indirect impacts:

• Contamination of lawns and trees with dust-polluted air masses from the land areas disturbed in the process of the construction work and handling of cement

(performed at the construction camp to be set up for the construction of a tunnel under the Smolenka River);

• Air pollution with exhaust gas from operating vehicles and the construction machinery at the construction sites.

During the *operational phase*, in case of repairs of motorway pavement, curbstones, and other repairs and maintenance work within greenery areas, it will be necessary to plan reclamation of greenery/lawns within the adjacent areas.

To prevent any negative indirect impact on the lawns and tree vegetation the following measures are planned:

- After the construction completion, compensation planting of species tolerant to exhaust gas and dust content of ambient air and soil pollution will be carried out;
- The maintenance regulation for the WHSD Central Section should provide for seasonal and current watering of trees planted along the motorway, including the spraying of tree crowns with water;
- Timely planting and seeding should be carried out.

Indirect impact on the vegetation within a range of 200m from the motorway during the operational phase will be caused by exhaust gas emissions from vehicles.

Experience of operating similar motorways indicates that stunting of vegetation takes place only within a range of a few tens of meters and is attributed mainly to the soil moisture conditions along motorways. In case of the WHSD motorway, this is important only for the WHSD Northern Section, where the motorway runs on an embankment.

To mitigate the identified impacts, the following measures are planned:

- Compensation for the damage inflicted to greeneries;
- Site improvement and revegetation in areas adjacent to the motorway and interchanges.

#### 6.9.2 Impact on Terrestrial Fauna

There are no areas with highly sensitive biodiversity of terrestrial ecosystems within the motorway corridor and its direct vicinity.

The WHSD Central Section construction will not be a decisive factor of impacts taking place in this area on terrestrial ecosystems, nor on waterfowl, wetland or wading birds.

The WHSD Northern Section construction will be a disturbance factor for large animals in the Yuntolovo nature reserve. Nevertheless, according to the results of monitoring conducted in the winter of 2011, elk and wild boar had not entered the area of the future WHSD Northern Section construction.

*During the operational phase of the WHSD Central Section* the most significant impact will be a westward shift of the resting grounds and flyways of waterfowl and wading birds as a result of cumulative impacts of construction work within the framework of the

WHSD and Marine Facade Projects and the construction of other artificial sites in St. Petersburg.

For the motorway's Northern Section, following public consultations, it was decided to modify design solutions: the motorway in the vicinity of the Yuntolovo nature reserve will not run on an embankment as initially envisioned, but on a flyover.

This will permit unobstructed migration of mammals under the motorway and minimize adverse impact on inflow of stormwater runoff and groundwater from the east toward the Yuntolovo nature reserve, i.e. preservation of unhindered functioning of the existing biotopes in the reserve.

To mitigate the negative impact of the Project on wildlife, a range of environmental mitigation and compensation measures has been planned.

During the *construction phase* impacts will be minimized by means of the following measures:

- Limitation of the construction work associated with the construction of the motorway within the area allocated for the Project;
- Prohibition to feed dogs at the construction sites.

During the *operational phase* the motorway will be illuminated during hours of darkness; the bridges across the Korabelny and Petrovsky waterways will also be illuminated from outside. This will minimize the risk of birds' collision with man-made obstacles.

It has been recommended as a compensation measure to install bird-boxes and provide floating platforms for water and wading birds within the Yuntolovo nature reserve.

#### 6.10 IMPACTS ON AQUATIC ECOSYSTEMS

Adverse impacts on the aquatic biota will be caused by the following factors:

- Irreversible alienation of part of the bay area for the construction of permanent piers;
- Temporary withdrawal of part of the bay for the construction of temporary islands;
- Increase in the water turbidity and deposition of an additional layer of bottom sediments within a certain area in the process of the construction of temporary islands as a result of dispersion of suspended particles of sand dumped into the water;
- Acoustic impact (a disturbance factor).

The main components of the damage inflicted to fish resources are as follows:

- 1. Irreversible loss of feeding grounds in parts of the Neva Bay and the Marine Canal used for the WHSD motorway piers;
- 2. Irreversible loss of a spawning ground at the western end of Krestovsky Island to be used for the construction of temporary islands;
- 3. Temporary withdrawal of some feeding grounds used by fish in the Neva Bay (for a period of 4 years) and in the area of the Marine Canal (for a period of 2 years);

- 4. Sliming of spawning grounds within the area of settlement of suspended matter, which would be covered with a layer of sediments over 5 mm thick at the western end of Krestovsky Island, to the south of the Park of the 300th Anniversary of St. Petersburg and on the Kanonersky shoal;
- 5. Death of plankton and benthos organisms or disturbance of their vital functions resulting in a decrease in the productivity of food supply resources for fish within the area of high water turbidity created in the process of the construction and removal of temporary islands.

The damage mentioned in the first two items is rated as permanent; the other three items belong to the temporary damage category.

The amount of compensation payment for damage to fish resources caused by the WHSD Central Section construction can be estimated to RUR 48,567,168, including RUR 16,378,200 and RUR 32,188,968 as compensation for permanent and temporary damage, respectively.

# The following measures are recommended for the Partner Company to mitigate the negative impact on aquatic bioresources damage to fish resources:

- It is required to comply with the prohibition of any underwater work within the water area of a body of water during the period of spawning migrations and spawning (from 15 April until 20 June) and take measures to reduce the noise level generated by construction tools, machinery and vehicles operating on the land near the coastline.
- In order to mitigate adverse impact on the Neva salmon resources it is required to suspend any work in the water area for a period coinciding with the peak of salmon spawning migration (from the beginning of freeze-up and to 15 June). Additionally, there are no construction works allow to be conducted in August-September, when Baltic salmon migrates for the spawning purposes through the system Neva Bay Neva River to the Ladozskoe Lake (approximately three weeks). The associated works can result in deterioration of the local water quality. Time and duration of these restrictions are defined by the Fishery Supervisory Bodies and based on the actual beginning and intensity of salmon spawning migration. For the construction of temporary islands it is recommended to use the "atoll" technology (installation of sheet piling and filling of gravel or laying bags of sand along the perimeter of a future island) to radically reduce entrainment of suspended matter to water.
- If such technologies cannot be applied, it is advisable to use clean coarsegrained sand (with a minimal content of thin particles) in areas of the construction of temporary islands for piers to minimize the water turbidity.
- When executing any work in a water area or on the shore it is required to take measures preventing contamination of the body of water with construction materials, garbage, petroleum products and other pollutants.
- After completing the work it is required to remove construction debris and waste from the coastal area, as well as any provisional structures and devices.
- Provide structural and technological solutions ensuring execution of hydroengineering work within the shortest possible time.

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• As a compensation measure it is recommended to release yearlings of European cisco *Coregonus lavaretus* L (indigenous freshwater species) to the Ladoga Lake. Such a compensation measure aimed at damage recoupment of fish supplies is established for the WHSD motorway construction by the Fishery Supervisory Bodies of Leningradskaya oblast.

#### 6.11 IMPACTS ON CULTURAL HERITAGE

There are no architectural, religious or other remarkable sites listed in the United State Register of Cultural Heritage Memorials directly within the WHSD Central Section area.

To minimize any negative impacts on objects of cultural heritage, the following measures have been foreseen in the course of Project design development, construction and operation of the WHSD Central Section:

• In case of any occasional archeological finds in the process of the construction work, any operations should be suspended until an assessment of the finds is done by archeologists. A chance find procedure, adopted by JSC "WHSD", is to be followed in such a case. If required, additional archeological rescue operations will be organized.

In order to reduce the vibration level in the adjacent areas, the following measures have been taken:

- The bases of the motorway supports will be constructed at a depth of 30-35m below the ground surface and will be placed on relatively plastic clays, which prevent propagation of vibration from the supports;
- The high quality of the road bed and pavement, as well as the fact that there are no joints, will guarantee smooth motion of vehicles over the WHSD roadway.

As a result, the WHSD motorway construction Project will not cause any negative impacts on cultural heritage objects.

# 6.12 VISUAL IMPACT ASSESSMENT

The visual impacts on the surrounding landscapes potentially imposed by the WHSD Central Section has been assessed from the viewpoint of conserving the esthetic, cultural and historic sites and creating a new skyline within the architectural environment of St. Petersburg.

The motorway design was developed taking into consideration the specific regulatory limitations with regard to architectural aspects, height parameters and compositional characteristics of new structures, as well as visual impacts related to perception of the existing landscapes by local resident and non-residents.

In the process of design development for the bridges across the Korabelny and Petrovsky waterways and the flyovers, the future architectural image of the Marine Facade as a whole was taken into account. In general and new outlines of the bridges their night-illumination should ensure, according to experts' assessments, contribute to the positive image of St. Petersburg's skyline

According to experts' assessments, the general outline and night illumination of the bridges will contribute to the positive image of St. Petersburg's skyline, making it more attractive as seen from the sea (Figures 6.12.-1-6.12-2).

*Figure 6.12-1* The proposed bridge across the Korabelny Waterway (future view from the Neva Bay toward the Bolshaya Neva River mouth)



Figure 6.12-2 The proposed bridge across the Petrovsky Waterway (future view from the Malaya Neva River mouth toward the Neva Bay)



ENVIRONMENTAL RESOURCES MANAGEMENT

#### 6.12.1 Measures for Impact Minimization

In order to minimize the visual impact of the Project, the following measures are proposed in the process of the elaboration of the Project design documentation, construction and operation of the WHSD Central Section:

- Additional planting of trees and shrubs in the areas adjacent to the new motorway within the framework of the site improvement and revegetation program;
- Timely land reclamation of areas temporarily disturbed during the construction • phase;
- Continuous management of site improvement and vegetation at the wayside within the sanitary distance range during the WHSD operational phase in accordance with the landscape architectural master plant;
- Issues regarding the visual aspect of night-time illumination of bridges and flyovers should be discussed with the general public and, if required, illumination should be minimized to a level needed to ensure traffic safety on the motorway.

#### 6.13 SOCIOECONOMIC IMPACTS

#### 6.13.1 **Positive Effects**

- Development of the city as an international center, increasing thereby business turnover, employment and tax revenues;
- Favorable effect on the construction sector of the city and the region as a whole;
- Improvement of the city's transport infrastructure;
- Ensuring round-the-clock traffic connection with Vasilievsky Island (currently the • islands is isolated during nights in summer because the bridges are open for navigation);
- Improvement of housing conditions for residents resettled from old housing on Kanonersky Island.

#### 6.13.2 Adverse impacts

- High noise exposure imposed on the residential areas immediately adjacent to the motorway, which, however, will be mitigated by noise protection measures;
- Temporary deterioration of the transport situation in the Kanonersky Island area during the construction phase;
- . Dismantling of social infrastructure facilities within the area affected by the motorway (kindergarten, sports grounds, cafés "Brig", "Umi" and "Morskoy Dvor");
- Deterioration of the access to social infrastructure facilities during the construction phase (No.379 School, "Priboi" Swimming Pool, foodstore, household chemical store, playgrounds for children, the Baltic Customs Office building);

- Displacement of lessees and owners for construction of the motorway and associated facilities;
- Demolition of private garages and a warehouse owned by CJSC "Farvater";
- Closure of unofficial recreational areas located along the Marine Embankment on Vasilievsky Island.

The WHSD Northern Section running to the north-east of the specially protected nature territory, i.e. Yuntolovo nature reserve, will affect the recreational urban park zone popular among the local residents. However, it is expected that the recreational areas and access to them in the vicinity of the Yuntolovo nature reserve will be impacted to a much more significant degree by the construction of a planned zoo, rather than by the motorway construction.

# 6.13.3 Impact Minimisation and Mitigation Measures

A range of measures aimed at minimizing the adverse socioeconomic impact of the Project will be taken in the process of the WHSD construction and operation. The most important ones are as follows:

- Resettlement of residents from 140 apartments on Kanonersky Island located within an area of high noise level;
- Relocation of the kindergarten and a sports ground located currently in the residential zone on Kanonersky Island;
- Compensation for the owners of garages to be demolished.

To reduce the traffic via the tunnel under the Marine Canal and within the street network of Kanonersky Island, providing access roads and optimizing the time schedule of cargo transportation is planned, taking into account the average daily traffic intensity patterns and rush hours, as well as timely notification of local residents about any planned limitation/ blocking of the traffic in connection with the construction of the WHSD flyover.

- minimize the use of the existing transport infrastructure on the island and the tunnel under the Marine Canal, especially during rush hours;
- rule out simultaneous blocking of the traffic along the entire WHSD route on Kanonersky Island;
- ensure timely and complete warning of local residents (through notices, the Project's website, radio and local newspaper) about the planned restrictions/ provisional blocking of the traffic in connection with the WHSD motorway construction.

Adverse impacts on the public health during the motorway construction and operation will be minimized by taking the following measures:

- replacement of the existing windows in affected buildings along the motorway Central Section route with soundproof windows before the construction commencement;
- installation of acoustic screens along the motorway route on Kanonersky Island and along individual segments on Vasilievsky Island;

- prohibition to carry out the construction work in the vicinity of residential buildings during the period from 11:00 PM until 07:00 AM;
- additional coordination of the time schedule of the construction work generating high noise levels with representatives of the adjacent social infrastructure facilities on Kanonersky Island (first of all No.379 school).

To mitigate the long-term negative impact of the Project on the residents of Kanonersky Island to be resettled, following steps will be required:

- conduct a census of the affected residents in accordance with the provisions of the Resettlement and Compensation Framework(RCF) Document;
- develop a Resettlement Action Plan (RAP), including the detailed description of entitlements, a grievance mechanism, consultation schedule and other measures aimed at adequate relationships with the residents to be resettled, in conformity with EBRD's PR 5 and on the basis of the RCF, as well as a system for monitoring the RAP implementation.

To rent land plots for technical zones required during the WHSD Central Section construction, the following measures are to be taken:

- conducting advance negotiations with the current lessees of the respective land plots;
- reaching an agreement on compensation in connection with the temporary use of the land plots, including a compensation for lost profit;
- reclamation and improvement of the temporarily rented land for technical zones during the WHSD Central Section construction.

In connection with the demolition of buildings, the following measures will be taken to minimize adverse impacts in the process of preparation of sites for the WHSD Central Section construction:

- Signing an agreement on compensation for demolition of the warehouse building of CJSC "Farvater";
- Update of Methodological Guidelines for the assessment of garages by the City's Department for Immoveable Property Inventory and Valuation (for the WHSD Central Section);
- Timely and comprehensive notification of garage owners and VOA district divisions about the planned time of beginning demolition and the procedure for compensation payment to garage owners who have confirmed their rights and title for garages;
- Setting up public reception offices to receive the required documents for compensation payment and provide information support;
- Creating a hot line for consultations on issues associated with garage demolition and compensation payments;
- In the process of the RAP implementation, the legal status of the cafés "Brig", "Umi" and "Morskoy Dvor" will be determined, and a procedure for compensation payment will be established in connection with their demolition.

To minimize impact on the social infrastructure on Kanonersky Island in the course of the Project implementation (No.74 Kindergarten, No.379 School, "Priboi" Swimming Pool, sports ground, the Department of General Practitioners, etc.) the following measures will be taken:

- Full-scale functioning of the above facilities (including the kindergarten and the sports ground after their relocation);
- Uninterrupted access for all residents of the island to the above facilities during both the construction and operational phases of the WHSD Project;
- Site improvement.

Improvement of the existing recreational areas in the vicinity of the WHSD route will be ensured by means of the following measures:

- Improving the areas allocated for the WHSD motorway construction after the construction completion;
- Planning pedestrian footways, passageways (at least four) and bridges in the area of the Marine Embankment with due consideration of the requirements for disabled persons;
- Providing access to the recreational areas of the Marine Facade site adjacent to the WHSD motorway;
- Providing access for local residents to the urban park zone in the vicinity of the Yuntolovo nature reserve during the WHSD construction and operational phase by constructing the motorway on a flyover, rather than on an embankment;
- Providing transport and pedestrian connection to the future zoo to be constructed in an area adjacent to the Yuntolovo nature reserve by providing an exit from the WHSD motorway;
- Developing design solutions that eliminate or minimize the use of the recreational area located in the western part of Krestovsky Island in case of potential construction of an exit from the WHSD motorway.

# 6.14 Environmental Monitoring and Supervision

# 6.14.1 During Construction

Construction contractors will be responsible to a significant degree for environmental monitoring and supervision during the construction phase.

The environmental protection division of the Partner Company must:

- Ensure compliance with the prohibition to carry out any construction work near residential areas 11:00 PM until 07:00 AM, as well as any work in the Neva Bay water area during periods specified by the Fishery Protection Agency;
- Ensure ongoing monitoring of dust and nitrogen dioxide concentrations in the ambient air in residential areas nearest to the construction sites;

- Ensure periodic noise level measurements at residential dwellings and school buildings, on residential, educational and office premises on Kanonersky Island and at the Marine Embankment;
- Monitor the compliance of construction contractors with the rules and procedures for arrangements and housekeeping in areas designated for the accumulation of construction waste, as well as in areas for the storage of fuel and lubricants;
- Ensure compliance with the dimensions of land areas specified in the Project design and allocated on a provisional and permanent basis for construction needs;
- Make sure that construction contractors have agreements for pumping out and removal for treatment of sanitary wastewater and for removal by specialist organizations of wastes from construction sites/camps for subsequent processing/disposal;
- Ensure periodic monitoring of the chemical composition of water pumped out from foundation pits and released after treatment to the Neva Bay;
- Ensure measurements of water turbidity in the Neva Bay at frequent intervals of time at stations located at a distance of 500m from areas designated for the construction of temporary islands;
- Monitor the compliance of construction contractors with the land reclamation designs in areas used during the construction phase for provisional facilities and along the routes of provisional roads.

# 6.14.2 During Operations

The environmental protection division of the Partner Company must ensure implementation of the following measures with the assistance of commissioned environmental contractor organizations:

- Continuous monitoring of nitrogen dioxide concentrations in the atmospheric air at houses facing the Marine Embankment on Vasilievsky Island;
- Periodic measurements of concentrations of harmful chemical substances in the ambient air at workplaces at the toll collection terminals in accordance with a time schedule to be approved by the sanitary supervision agency;
- Periodic measurements of the levels of harmful physical impact factors in the yards and inside apartments, on educational and office premises in the buildings located at distances of up to 200m from the motorway in accordance with a time schedule to be approved by the sanitary supervision agency;
- Monthly monitoring of the efficiency of stormwater treatment facilities for runoff from the WHSD motorway;
- Periodic monitoring of process of subsidence/deformation of flyover and bridge structures;
- Regular monitoring of the chemical and microbiological composition of drinking water used by the WHSD operating personnel in accordance with the procedure approved by the sanitary supervisory agency;

 Setting up a network of benchmarks on the roadway and on the road embankment slopes, as well as periodic geodetic surveys to monitor the roadway and slope stability.

The planned environmental monitoring and supervision system will permit the collection of sufficient data and information required for an efficient environmental management of the WHSD motorway and for regular preparation of reports for all stakeholders about the environmental status of the WHSD motorway and the areas potentially affected by it.

#### 6.15 SAFETY AND SECURITY ISSUES

#### 6.15.1 Safety and Security Infrastructure Facilities

Uninterrupted and safe traffic of vehicles on the WHSD motorway after its commissioning will be ensured by the following measures:

- Compliance with the technical solutions proposed in the Project design, such as median dividing strips between the lanes of opposite directions; road guards, road signs, electronic information boards, fog and signal lamps; road marking; construction of safe exit and entry ramps; selection of appropriate paving materials; on bridges automatic deicing systems;
- Installation at minimal intervals (not more than 1km) of emergency phone units;
- Timely receipt and appropriate use of information from the central control station about possible weather changes, road paving condition and traffic situation;
- Installation in the tunnel of exhaust gas concentration sensors and emergency ventilation system, as well as provision of emergency exits;
- Timely and adequate execution of road maintenance work to ensure compliance with stringent operational requirements;
- Appropriate strategy of road maintenance in winter based on preventive measures rather than response to negative impacts of weather factors on the operational condition of the motorway and associated facilities.

In case of accidental situations the following operational control measures will be taken:

- Mobilization of emergency response and rescue services prompt warning of dispatchers of the emergency response and rescue services and road traffic control services about any accidental situation with indication of its classification;
- Warning of traffic participants about a dangerous road situation along the traffic route with the aid of on-board, external and personal technical communication means;
- Ensuring first-priority movement of the emergency response and rescue services to the accident location;

• Ensuring support in case of special transport missions (transportation of children, escort of vehicle convoys and processions, designation of a special road lane).

#### 6.15.2 Safe Handling of Hazardous Materials

The following measures are planned to prevent release or spills of hazardous substances in the process the WHSD Central Section construction:

- To prevent accidental spills of petroleum products in the process of filling vehicles or machinery a containment tray will be installed under the respective construction machinery unit or vehicle. Any operations with petroleum products on provisional islands in the Neva Bay will be performed only with visual supervision by the personnel responsible for such operations;
- Maintenance of construction machinery will be carried out only at permanent bases or in special areas designated for this purpose which have pavement to prevent migration of spilled fuel or lubricants into the ground and groundwater;
- Containers will be installed at construction sites for the collection of construction waste, metal scrap, wooden waste, as well as special containers for oily wiping materials and oil-polluted soil; all wastes will be disposed of separately depending on their hazard classes;
- Measures will be taken to prevent release or migration of binding materials, activating agents and surfactants into soils/water in the Neva Bay in areas adjacent to the construction sites.

# 6.15.3 Safety Measures to be Taken when Transporting Hazardous Materials on the WHSD Motorway

An analysis of emergency situations recorded in the process of transportation of hazardous materials has shown that the most dangerous accidents occur in case of transporting ammonia, chlorine and inflammable liquids (petroleum products). To minimize the risk of such accidents, the following measures are to be taken:

- Carry out scheduled testing and systematic checking of vessels, gas cylinders and containers designed for the transportation of hazardous chemicals, inflammable and combustible liquids by trucks;
- Only persons who received special training and are duly authorized will be permitted to drive vehicles used for the transportation of hazardous substances;
- Preliminary approval of transportation routes and timeframe for transportation of hazardous substances on roads are to be obtained from the emergency response agency and the traffic police;
- Strict compliance with the approved route and speed limits;
- Use of video surveillance systems to monitor vehicles and traffic situation in especially hazardous sections of the transportation routes.

To prevent migration of hazardous chemicals (in case of accidental spills) to stormwater drainage networks to be installed along the entire WHSD motorway, large-volume settling chambers will be provided in the primary stormwater drain manholes. Hazardous substance will be removed from such settling chambers after the accident containment with the aid of special equipment.

#### 6.16 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

#### 6.16.1 The Company's OHS System and Policy

A Partner Company, to be selected on the competitive bidding basis, will be responsible for OHS management in the process of the WHSD Central Section construction and the operation of the entire WHSD motorway. The Partner will be responsible for the entire range of OHS issues related to its own personnel and construction contractors' personnel, as well as specially employed operating personnel.

It is also expected that the Partner will ensure within a reasonably short time preparation and implementation of its own OHS Policy and an OHS management system in accordance with the international standard OHSAS 18001 or similar.

#### 6.16.2 Basic OHS Measures

The following main OHS measures are to be taken by the Partner in conformity with the Russian legislation:

- Development and approval of its own OHS regulations and instructions for different types of work/ checking that contractor organizations have such instructions in place and apply them;
- Supervision over contractors' operations to ensure safe working conditions, development and implementation of measures aimed at reducing the exposure of its own personnel to harmful impacts;
- Briefing and training of its own employees and checking of their knowledge, as well as supervision over compliance with the adopted procedures in contractor organizations;
- Provision of its own personnel with special work clothing in accordance with the prescribed norms, as well as with appropriate personal protection equipment; supervision over compliance with the respective regulations in contractor organizations;
- Recording and investigation of occupational accidents and incidents occurring through the fault of its own personnel; analysis of the causes of accidents in contractor organizations and implementation of measures to eliminate the identified causes;
- Attestation/certification of workplaces to assess their compliance with sanitary and hygienic regulations and norms with regard to workplaces of its own personnel; supervision over compliance with this rule in the contractor organizations ;

• Primary and periodic medical examination of its own personnel; supervision over compliance with this rule in the contractor organizations.

The above measures will be implemented by the Partner in the process of the WHSD Central Section construction and the operation of the Southern Section. After commissioning of the Northern Section, those measures will be taken at all facilities and in the process of any work to be carried out on the WHSD motorway.

#### 6.17 Environmental Impacts in Case of Potential Accidents and Emergencies

It may be concluded on the basis of the available practical experience that the following most typical accidental situations might occur in the process of construction and operation of motorways incorporating flyovers and bridges:

- 1. Flyover/ bridge failure in the process of work execution;
- 2. Flooding of construction sites, landslides in excavated foundation pits, and fires;
- 3. Road accidents entailing significant expenses; accidents with vehicles transporting toxic or flammable substances.

The most dangerous hypothetical accidents during the WHSD operational phase, which can cause emergency situations, are associated with the transportation of hazardous chemicals: ammonia, chlorine and inflammable liquids (petroleum products).

The probability of such accidents was estimated in the WHSD construction design at 10<sup>-6</sup>, i.e. it will not exceed the average for this type of motorways.

Such accidents can entail the following consequences:

- Pollution of atmospheric air with combustion products and vapors of hazardous chemicals;
- Pollution of surface and underground waters and soils with spilled substances (petroleum products, hazardous chemicals);
- Destruction of buildings and other structures;
- Death and poisoning of personnel and local residents.

Accident prevention and response plans for the above types of potential accidents will be drawn up. The Plans will provide for the following:

- Ongoing maintenance of the roadway and associated auxiliary facilities in proper condition;
- Functioning of the warning and alert systems;
- Provision of required human and material resources within a distance ensuring their prompt mobilization to the accident site. Storage of a reserve of reagents for response to spills of up to 25 tonnes of petroleum products is also required.

It had been assessed in the Project design that potential accidents during the construction phase can affect only minor areas, without any serious consequences for the ambient environment. In addition to the existing Project design, there is a requirement to address the risks associated with adverse ice processes in the mouths of the Bolshaya and Malaya Nevka Rivers, which could become more active because over

60% of the riverbed cross-sections of those rivers will be blocked by the temporary islands and dams in the process of the WHSD construction

ENVIRONMENTAL RESOURCES MANAGEMENT SUMMARY

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