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METHODOLOGY OF APPLICATION OF GEOINFORMATION SYSTEMS FOR THE ORGANIZATION OF THE IMPROVEMENT OF THE TERRITORIAL COMMUNITY

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It has been proved that the geoinformation system of a territorial community is an innovative electronic cartographic resource aimed at the maintenance of the targeted and comfortable community assets management, mainly, the natural, water, forest, mineral, and land resources, engineering, and transport, social, tourist infrastructure, the investment potential of a community providing for the operative communication between the residents and administration of a community.

The objective of the Research is to display the amenities of the Lviv Territorial Community according to their function based on their rational application and protection considering the local Building Rules with the implementation of Geoinformation Software QGIS. With the help of the application of the plug-in QuickOSM it displays the vector data of the amenities within Lviv Territorial Community, mainly, the keys "landuse recreation", "landuse landfill", "leisure park', "leisure garden", "water", "highway", and "waterway".

The feasibility of QGIS application for the vector display of amenities within Lviv Territorial Community is presented that shows the advantages of visualization, quick access, administration, and actualization based on the open resources of access to the cartographic materials of the geoportal of Lviv that provides for convenient maintenance of the cartographic database and inventory of the utility system, accounting, and operative inventory of the municipal property objects.

Keywords: *Geoinformation systems, geoportal, geoinformation software QGIS, plug-in QuickOSM, amenities, territorial community.*

Topicality. GIS is the information and analytical systems that contain the databases and means of cartographic visualization for the display of different objects for the analysis of changes in their territories. In cartographic format, they provide the data on the land resources, industrial objects, transport, environmental or construction restrictions, demographic and sociological data, and materials of the urban planning documentation. Thus, with the application of the geoinformation analysis, the expediency of the creation of a new enterprise, the opening of a hospital, or a school may be determined, and the related amendments in the plan of the territorial community development may be reflected with a conclusion on what will have the biggest effect and will allow for the efficient administration of its assets, facilitation of the maintenance of electronic document flow. “Besides, the geoinformation systems allow for the sharing of data between different services and structures, and provide for access of the public to the open data through their display on the web portals” [1], having thus provided for the operative information concerning the needs and changes within the territorial community.

Analysis of the last studies and publications The Study by K. Mamonov [1] determines the directions and features of the application of geoinformation systems in the process of the land use of Ukrainian cities. V. Opara and S. Vynohradenko [3] provide insight into the peculiarities of GIS technologies that condition the efficiency of the application and space planning in residential areas. The study results [6] concerning the application of GIS technologies and Earth remote sensing are actively elaborated and implemented into the management practice for the assessment of te growth and territorial expansion of cities.

Objective of the Research. To display the amenities of the Lviv Territorial Community according to their function based on their rational application and protection considering the local Building Rules with the application of Geoinformation Software QGIS.

Materials and methods of the Research. The Study applies the data of the geoportal of the Lviv City Territorial Community subject to the analysis for completeness and relevance using the geoinformation software QGIS. «Using the

plug-in QuickOSM it displays the vector data of amenities that include the works in the arrangement and reconstruction of the pavements and sidewalks, equipment with the traffic security appliances, landscaping, arrangement of the outdoor lighting and outdoor advertising, arrangement of the small architectural forms, garden and park furniture, other steps aimed at the improvement of the technical and sanitary condition of the territory, residential comfort of the residents and guests of Lviv City Territorial Community.» [5]

Study results and discussion. The geoinformation system of a territorial community is an innovative electronic cartographic resource aimed at the provision for the targeted and comfortable community assets management, mainly, the natural, water, forest, mineral, and land resources, engineering and transport, social, tourist infrastructure, the investment potential of a community that provides for the operative communication between the residents and administration of a community.

The architecture of the geo-portal of Lviv City Territorial Community applies the principles of modularity, unity of technologies, and presentation of the geospatial information using Internet technologies. Fig. 1 displays the layer of amenities of Lviv during the geoportal operation, where each module of the geoinformation system may operate independently, which allows for its gradual complement.

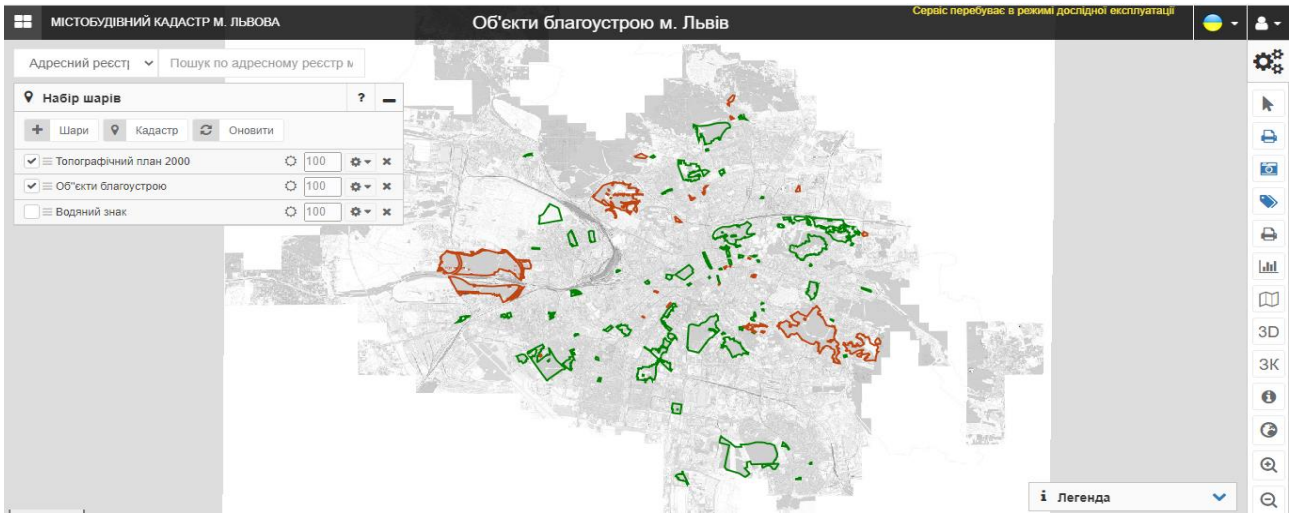

Fig. 1. Displayed layer of amenities of Lviv during the operation of the geo-portal of the Lviv City Territorial Community.

Through QGIS upload the boundaries of the Lviv City Territorial Community using the panel “Catalog”, having chosen the instrument “Tile Server (XYZ)” to

create a “New Connection”, where the reference for TMC layer should be indicated http://mbk.city-adm.lviv.ua/map/rtile/carto_249225391506456689 9/ua/{z}/{x}/{y}.png (рис. 2) [2].

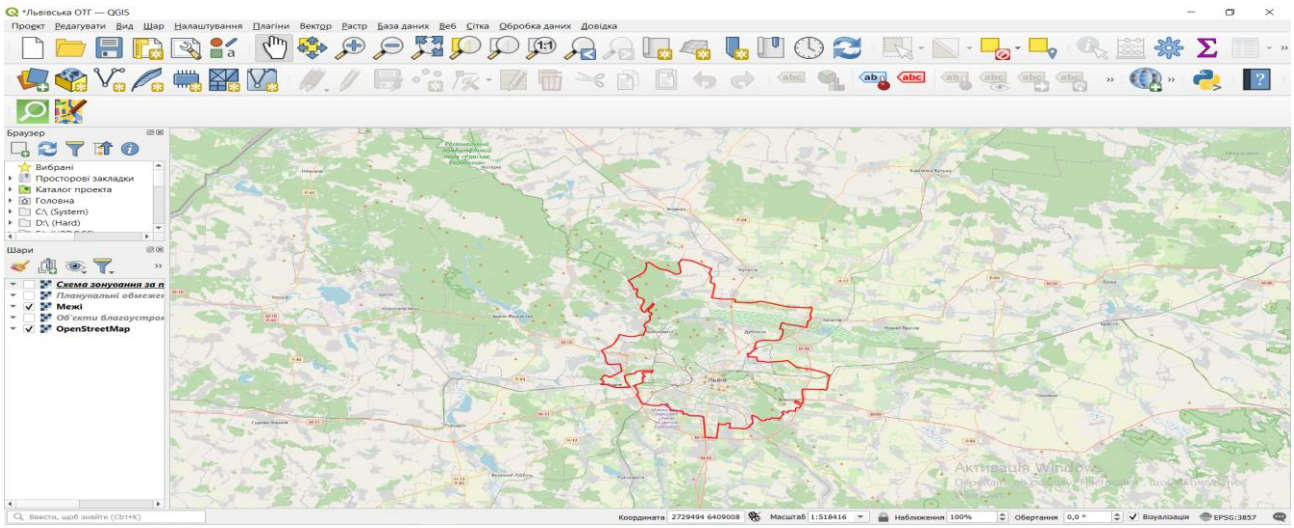

Fig. 2. Boundaries of Lviv City Territorial Community in the geoinformation software QGIS.

The amenities on the territory of Lviv City Territorial Community are used with regard to the legal, economic, environmental, social, and organizational bases of the city improvement aimed at the creation of conditions favorable for human life and activity.

To display the layer of amenities within Lviv City Territorial Community in geoinformation software QGIS, indicate a reference to the TMS layer http:////mbk.city-adm.lviv.ua/map/rtile/carto_2368962364167948196/ua/{z}/{x}/{y}.png [2], where after pushing the OK button, choose “Add a layer” from the drop-down list (fig. 3).

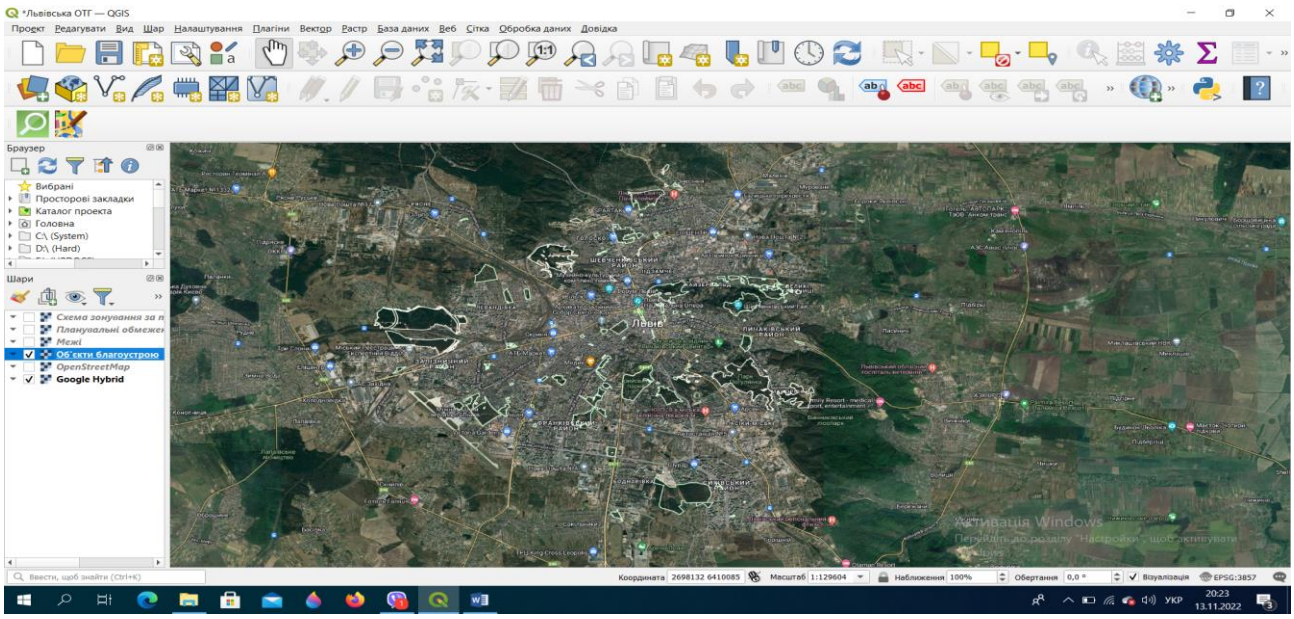

Fig. 3. The display of the layer of amenities within the Lviv City Territorial Community in geoinformation software QGIS according to the data of geoportal.

«According to the "Regulations on the amenities and maintenance of the territory of Lviv", the amenities of the city include:

- Street-and-road network (ground canvas and roadway of the streets, roads, squares, driveways, sidewalks, passenger and bike lanes, car parks, drainage systems, underground passages, pipes, small bridges, parking zones, etc.);
- artificial constructions within the street-and-road networks (bridges, flyovers, overpasses);
- household and municipal equipment of the residential areas (garbage collectors, drying sites, sites for leisure and children's entertainment, sports, cultural events, etc.);
- green areas (parks, common-use gardens, green areas of the streets, roads, residential areas, and sanitary protection zones);
- Small architectural forms (benches, urns, canopies at the bus stops, fences, kiosks, billboards, garden houses, decorative sculptures, and compositions, monuments, arrangement of the playgrounds and sports grounds, flower vases, fountains, and decorative pools);

- street lighting and outside electric mains (electrical equipment, including the power lines with a voltage of about 1,000V, control communication equipment, automatics, automatic remote control);
- hydro-technical and anti-slide structures (artificial and natural water reservoirs, dams, barrages, coastal fortifications, embankments and retaining walls, stairs, parapets, drainage systems, etc.);
- cleaning and sanitation facilities (drainage stations, landfills for solid household wastes, waste transfer stations, public toilets);
- simple water supply facilities (pump stations near the water reservoirs for watering purposes, fire water reservoirs, mine and mechanic wells, and points of water filling for the watering machines)» [4].

In the work with the layer of amenities within Lviv City Territorial Community in QGIS received from open access to the geoportal of Lviv City Territorial Community, among all amenities of the city only the public parks 3), are displayed. Therefore, fig. 4 shows the application of plug-in QuickOSM in geoinformation software QGIS, mainly, “landuse recreation” - public green leisure space, “landuse landfill” where the wastes are deposited, “leisure park” - municipal park, “leisure garden” - a place where the flowers and other plants are grown, and “water” - a category that embraces the water resources [7].

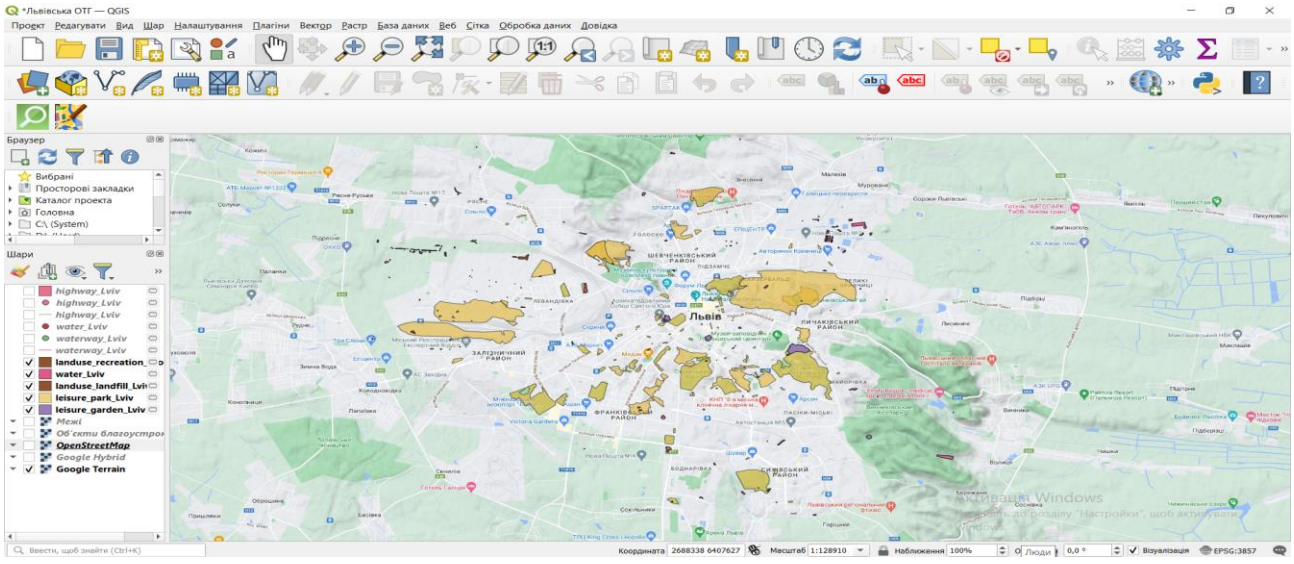

Fig. 4. The display of the layer of amenities within the Lviv City Territorial Community in geoinformation software QGIS using the plug-in QuickOSM.

Besides, fig. 5 through the plug-in QuickOSM in the geoinformation software QGIS displays the objects of street-and road-network “highway” and water supply routes “waterway” [7].

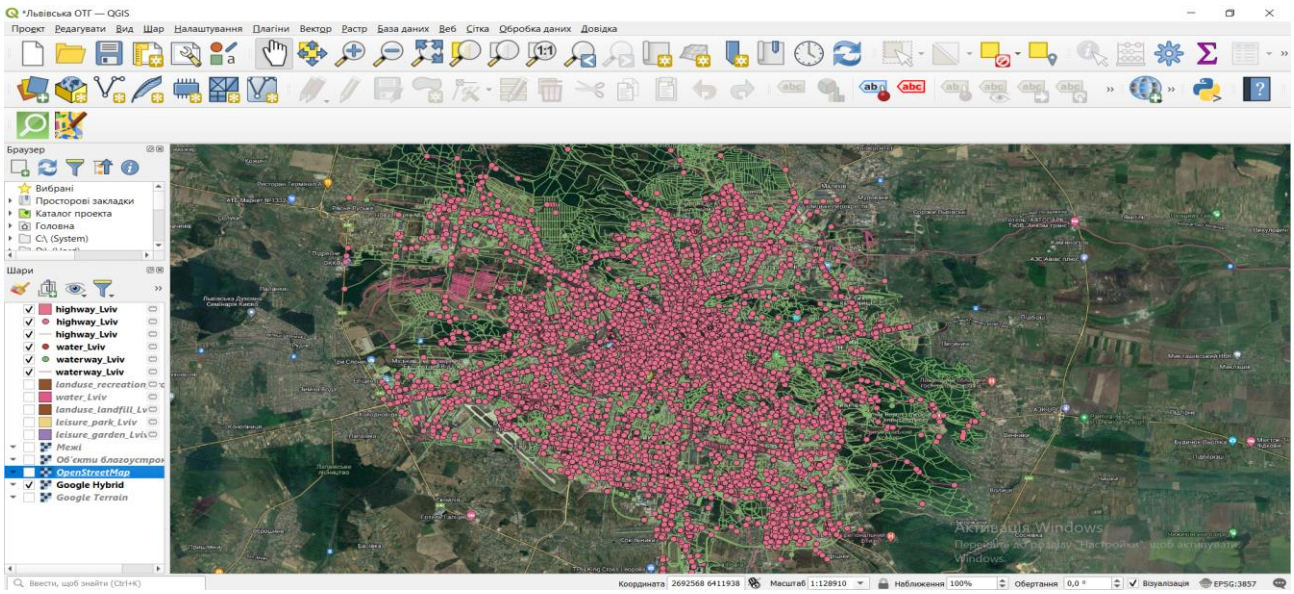

Fig. 5. The display of the layer of the street and road network and water supply routes within the Lviv City Territorial Community in geoinformation software QGIS using the plug-in QuickOSM.

To visualize, control, and analyze the geospatial data using the plug-in QuickOSM in geoinformation software QGIS, upload the OSM data through Overpass API operating as a database that corresponds to the client’s request. For this purpose, first of all, a basic map Open Street Map should be added to QGIS.

Fig. 6 shows the deactivated basic map Open Street Map for better display of newly uploaded layers “highway” and “waterway” that also belong to the amenities within the Lviv City Territorial Community not simultaneously displayed at the geoportal of Lviv.

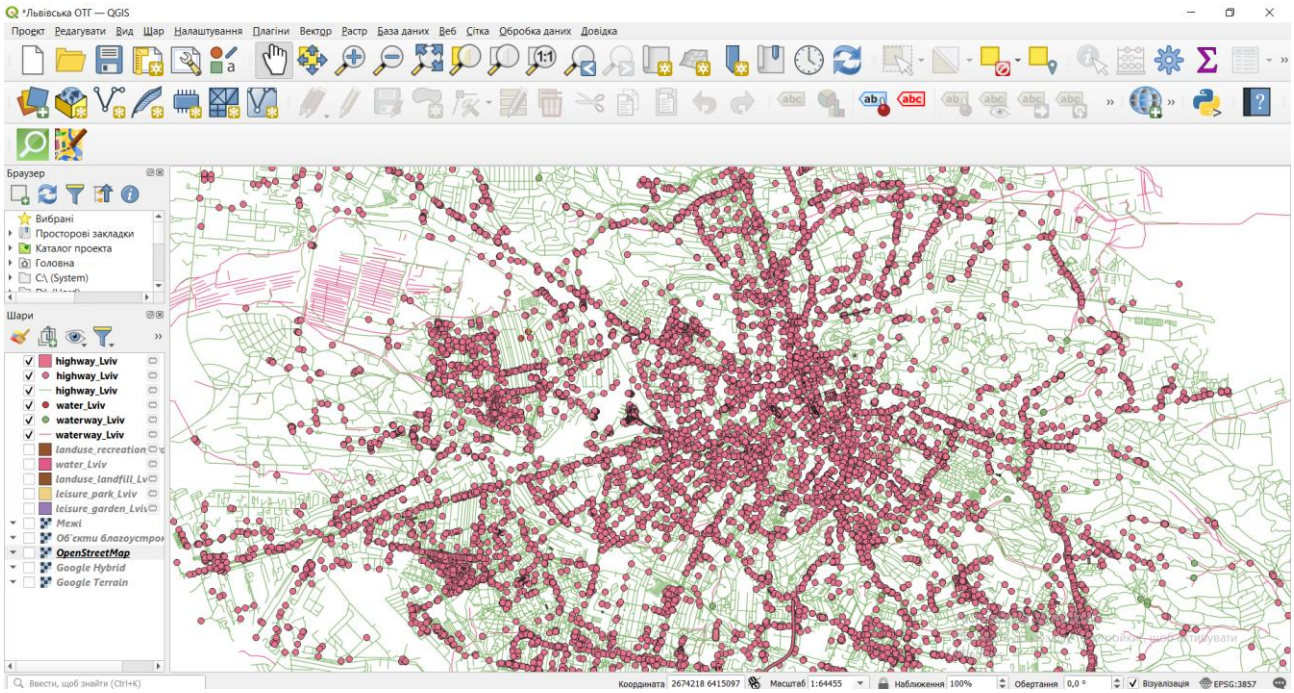

Fig. 6. The vector display of the street and road network and water supply routes within the Lviv City Territorial Community in geoinformation software QGIS.

Conclusions and perspectives. QGIS is a multi-functional geoinformation system with open code. Through this system, unhindered access may be gained to the relevant OSM data easily exportable to the user-friendly geospatial database.

The possibilities of the application of geoinformation software QGIS for the vector display of the amenities within the Lviv City Territorial Community demonstrated the advantages of visualization, operative access, administration, and actualization based on the open resources of access to the cartographic materials of geoportal that presupposes the convenient maintenance of the cartographic database and inventory of the municipal property objects. The proposals presented on the methodology of using the geoinformation system QGIS for the organization of the improvement of the territorial community of Lviv can be used at the same time to organize the territory of any other territorial communities.

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Нарадовий Б.

МЕТОДИКА ЗАСТОСУВАННЯ ГЕОІНФОРМАЦІЙНИХ СИСТЕМ ДЛЯ ОРГАНІЗАЦІЇ БЛАГОУСТРОЮ ТЕРИТОРІАЛЬНОЇ ГРОМАДИ

Доведено, що геоінформаційна система територіальної громади – це інноваційний електронний картографічний ресурс, головне завдання якого полягає у забезпеченні цілеспрямованого та комфортного управління активами громади, а саме природними, водними, лісовими, мінерально-сировинними та земельними ресурсами, інженерно-транспортною, соціальною, туристичною інфраструктурою, інвестиційним потенціалом громади, що забезпечує оперативну комунікацію громадян та керівництва громади.

У дослідженні поставлено за мету відобразити об’єкти благоустрою Львівської міської територіальної громади згідно з їх функціональним призначенням на засадах їх раціонального використання та охорони з врахуванням місцевих правил забудови, використовуючи геоінформаційну програму QGIS. У ній за допомогою застосування плагіну QuickOSM відображено векторні дані об’єктів благоустрою в межах території Львівської міської територіальної громади, а саме ключів «landuse recreation», «landuse landfill», «leisure park», «leisure garden», «water», «highway» та «waterway».

Представлено можливості застосування геоінформаційної програми QGIS для векторного відображення об’єктів благоустрою в межах території

Львівської міської територіальної громади, що відображає переваги візуалізації, оперативного доступу, адміністрування та актуалізації на основі відкритих джерел доступу до картографічних матеріалів геопорталу м. Львова, який передбачає зручне ведення картографічної бази даних та інвентаризації інженерних комунікацій, обліку та оперативної інвентаризації об’єктів комунальної власності.

Ключові слова: геоінформаційні системи, геопортал, геоінформаційна програма QGIS, плагін QuickOSM, об’єкти благоустрою, територіальна громада.